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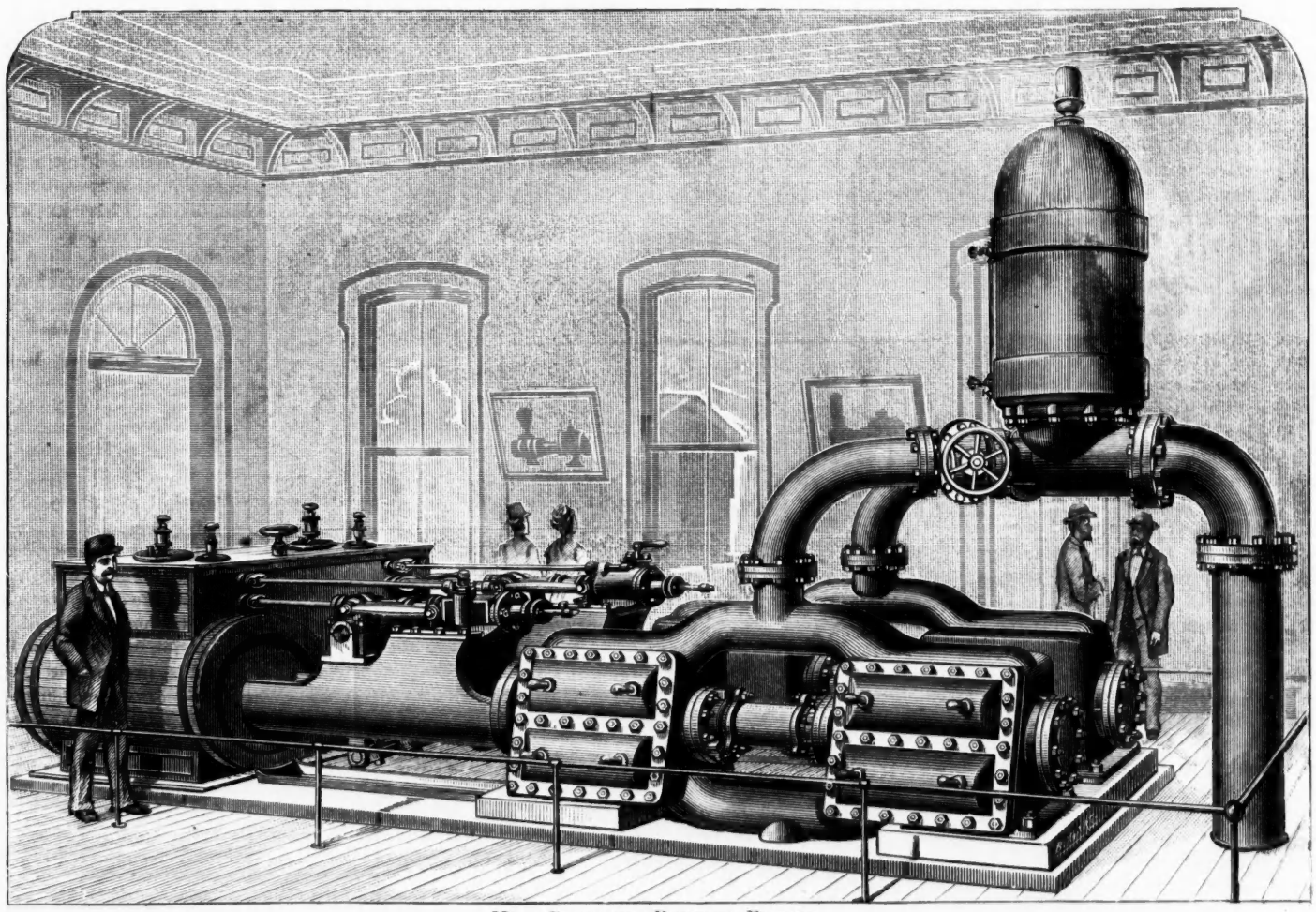
A New Type of Compound Pumping Engine.

Those interested in water-works matters are well aware that economy of fuel is a great consideration in pumping engines.

Actual economy should also bear reference to the interest on the investment, and to the cost of operation and maintenance, as well as the duty performance.

For towns or cities of small size, the problem has been to provide a pumping engine which would allow the investment and cost of attendance and maintenance to be brought down in a fair proportion to the desired capacity of the works, without detracting from the much-desired duty performance.

The problem was one deserving and receiving the best thoughts of the best engineers of the world, and experience seems to have shown that in pumping engines "high duty" involves high grades of expansion. This was not obtainable with the old type of direct-acting pumping engines, where steam was used at constant pressure throughout the full length of the stroke, and then exhausted at that pressure into the atmosphere without doing any further work.



NEW COMPOUND PUMPING ENGINE.

The direct movement of water by the direct movement of a steam piston acting on a piston or plunger in the pump, is the most natural and desirable plan for moving water, hence the necessity of adopting some method of combining the direct-acting movement of the piston or plunger to a pumping engine that will work the steam in an economical manner. In order to accomplish this, we are led to the compound engine, in which the steam does a portion of its work in one cylinder, operating one plunger or piston of a pump, and then expands into a second cylinder, whose piston operates another plunger or piston of a pump. In such an engine, we do not suppress the attenuation of force which is found in single cylinder engines; but by an attenuating reaction on the first piston, we find the force equalized to such a degree as to render expansion of practical utility for pumping purposes. The equalization may be rendered more perfect by means of a receiver between the cylinders.

This receiver becomes a reservoir, the density of whose contents becomes augmented and decreased by inflow and outflow: but owing to the addition it makes to the volume affected, the variation produced in the pressure is lessened. In the design of such a pumping engine, the areas are so proportioned that the constant force exerted by the inflowing steam in the first cylinder, added to the varying force of the steam expanding from the first to the second cylinder, less the varying resistance upon the first piston, due to the reaction of the steam acting in the second cylinder, added to the force due to vacuum, if any, in the second cylinder, shall equal the work to be done.

The two steam pistons, moving coincidently, the grade of expansion is dependent entirely upon the relations of the areas of the steam pistons, and the space they move through. The relation of the areas of the pistons are determined by the pressure of steam carried, by the grade of expansion determined upon, and by the measure of work to be done.

Such a machine is shown by the accompanying engraving; they are constructed up to eight million gallons for twenty-four hours' capacity. Engines of this new type are now in operation at the water works of Milwaukee, Wis., Cincinnati and East Liverpool, Ohio, and Trinidad, Colorado. The machine consists of two direct-acting pumping engines delivering into one main. There is no connection between the two, save by the steam and water pipes.

Their motions are entirely independent, and are so piped and valved that either one may be operated independently of the other. In our issue of June 28th, 1879, we described at length the ingenious "Isochronal" device, which insures a perfect regulation of speed to a pumping engine. In the present case the first engine receives its steam as usual, and exhausts into a large receiver beneath the floor. The second or low-pressure engine takes its steam from this receiver, and exhausts into the atmosphere or a condenser.

The low-pressure cylinder is made equal at least in power to the high-pressure cylinder. An Isochronal device is attached to the low-pressure engine, but it is so adjusted as to regulate within prudent limits only.

The perceptive reader will at once see that we have here a self-adjusting, variable-expansion, direct-acting pumping engine.

The grade of expansion is varied by a change in the comparative practical volumes of the cylinders, and this change is effected by a change in the number of strokes of the low-pressure piston, whose motion is in no ways dependent on the motion of the high-pressure piston.

Certain pressures being required of the low pressure piston for the work in hand, this piston will adapt its own motion so as to maintain that pressure in the receiver from which it draws its steam. In practice the engines are proportioned for the work, and practical changes in conditions cause a variation in the comparative number of strokes of the two pistons of not to exceed five per minute. The simplicity and perfection of this arrangement will be at once apparent, as well as the peculiar facilities afforded for the conversion of the low-pressure engine into a high-pressure engine for fire duty; also, the facilities with which each engine may be used in emergencies, independent of its fellow. In the normal operation of this machine, one throttle gives control of the whole. This engine is made by the Cope & Maxwell Manufacturing Company, Hamilton, Ohio.

There are hundreds of men in our large maritime cities who could buy a steam launch for pleasuring purposes, if the boats are cheap enough and their merits and cost properly made known. With facilities for manufacture, and a reasonable confidence that numbers of good, safe and low-priced boats can be sold, there would seem to be room for a growing business in this direction.

Wooden vessels, and even iron sailing ships, are no longer in demand in England, the number built during 1880 being unimportant and required for special trades. Steel, though considered costly, is daily increasing in favor. Some builders declare it the ship material of the future.

Extracts from Chordal's Letters.

THE MEN WHO DESIGN MILLS AND SHOPS—CHARACTERISTICS OF PROFESSIONAL AND NON-PROFESSIONAL MEN—ARCHITECTS WHO FAIL IN DESIGNING INDUSTRIAL WORKS—INCONVENIENCES IN MACHINE SHOPS—THE USUAL EXPERIENCE IN BUILDING AND EXTENDING THEM.

Mr. Editor:

* * * * I am on the hunt for an architect who has made a study of industrial works. I know of lots of them who pretend to make a specialty of such business, and who can point with pride to many magnificent shops, mills, factories, etc., in which the exterior seems to indicate a special fitness within. But when we come to investigate these establishments, we find them full of architectural blunders. The utility of a thing seems to be entirely outside of the architect's range of comprehension. A canvas awning, or a business sign, put on a building, disarranges all the architect's calculations; in fact, I never heard of one of

them showing a sign on an elevation. I suppose they would protest if asked to dot one in, just to see how it looked. It might spoil the looks of the drawing. The New York post office is a fair sample of functional architecture. It was, or was supposed to be, designed for the manipulation of mail matter and the transaction of postal business; but no proper calculation was made for light, and no means were provided for getting mail into the building, or for getting mail out. A wooden addition, with some common sense in it, had to be resorted to, before the place was at all fitted for the very work it was intended for.

* * * * Modern mill architecture has apparently fallen into the hands of mill operators, who, as a class, know as much about mill designing as a woman does about designing a kitchen. The modern mill is designed by a millwright, or an operative, and the modern machine-shop design springs from the brain of a machinist.

* * * * The mechanical engineer lives, and works and deals with machinery and machine work. He is a designing mechanic, with observation and executive faculties. He also works with drawing paper and tee-squares and compasses and bow pens and dotted lines, and talks freely of elevation, section, plan, and detail.

It would look as though such a man was an engineer and architect combined in one machine; and that if he wanted to design a building for industrial purposes, in his line, all he had to do was simply to do it.

* * * * I have always divided men into two classes, professional and non-professional, to the disparagement of neither. Among non-professional men, I class those who carefully treasure every scrap of past experience, and who are guided by their accumulations of experience.

Among the professional men, I class those, who, without any special attempt to gain experience themselves, are constantly and forever absorbing the experience of others. If the non-professional never did a certain thing, he knows nothing about it. After he has done it, he gets one man's experience. The professional man, without ever intending to do a certain thing, may have thorough knowledge of the world's experience in that thing. To him the books bring the lifetime experience of ten thousand lives. Knowledge of others' failures will divert his thoughts and acts into original channels. The non-professional leaves on record the experience of one small life, and the professional man gathers in thousands of these. The non-professional man may grope alone a life-time after one small fact, stored in a business-like way in the head of the professional man. The professional man's mind is a valuable text book in the school of experience, which the book itself may never attend.

It has taken all this philosophy to bring me to the conclusion that an architect ought to be able to tell me something useful about houses, especially as my sole experience consists in a dissatisfaction with the last one I lived in.

* * * * When the machine man builds a shop, he botches it.

I don't know just why this should be so, but I have often noticed that new establishments, contrived with a definite purpose in view, have almost always proved the most awkward, and ill-fitted for their use.

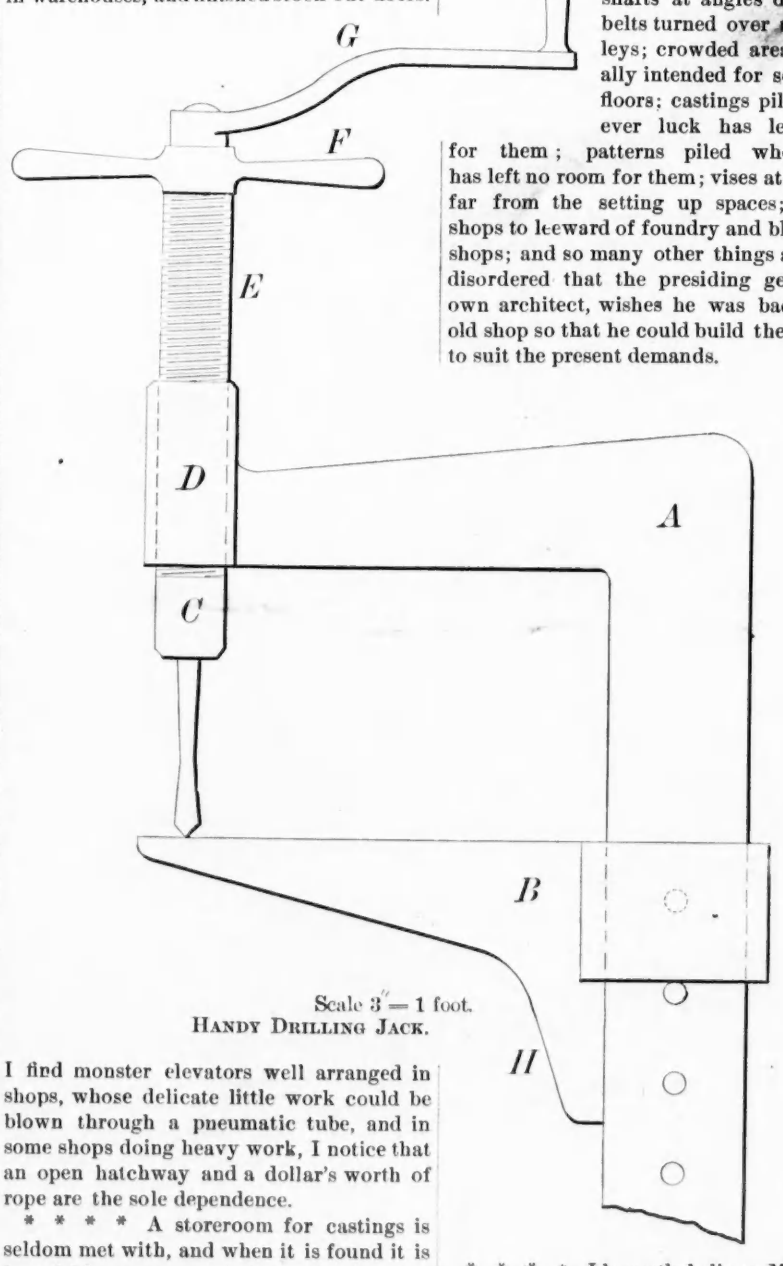
Railroad shops, designed by some master mechanic with every possible point in view, are generally an abomination; and I only know of one way to get them built worse, and that is to set an industrial architect at the job.

If some of our technical colleges will establish a chair of shopitecture, in which a knowledge of the ancient past forms a bar to approach, I believe the world would be a trifle advanced.

* * * * The fact is, Mr. Editor, that I want to build a shop. I am a mechanic myself. I know "how to set a slide valve," and how to cut a thread on chilled iron, and how to wash old waste, and how to unscrew a rusty nut, and lots of things; and I know how to "draft" and how to figure up the weight of cast iron, and all such, but I have seen lots of shopmen far better and wiser than I, get up miserable shops. I don't want any such side issue to enter in on my life, and for that reason I seek far and wide for the man who can measure me for a shop as a shoemaker would for a boot.

* * * * With a full knowledge that I may have to be my own shoemaker, I am now looking at crack shops, and if you could set instantaneous pictures in type, I could send you a volume on modern shop architecture.

* * * * The best arrangements I have seen for handling heavy work have been in shops that never have made, and never intended to make, anything weighing a ton. I find heavy tools and heavy work done on sky floors, and tinkering work done in one-story shops. I find well-arranged cranes fixed where small tools run, and see the heavy lifting, around big planers and lathes, done by pure back muscle. I find raw stock in warehouses, and finished stock out-doors.



Scale 3″ = 1 foot.
Handy Drilling Jack.

I find monster elevators well arranged in shops, whose delicate little work could be blown through a pneumatic tube, and in some shops doing heavy work, I notice that an open hatchway and a dollar's worth of rope are the sole dependence.

* * * * A storeroom for castings is seldom met with, and when it is found it is invariably so arranged that it is simply a casting pile under roof.

A casting storeroom systematically arranged and adapted to contain all the standard and wild castings of a concern; a place where the foundry's delivery ends; a place where the machine-shop's receipt of cast stock begins; a place where every stock casting belongs, and can be actually found, is a rare sight.

It is so useful a thing, so economical of valuable time, so convenient, and so absolutely void of expense that it is hardly to be looked upon as a refinement or a luxury.

* * * * The power of extension is the great architectural feature in a shop. The presiding genius may deliberate and dream over the new shop; may lay down on drawing paper every machine and area which the fairest and most prophetic anticipations can suggest, and when done he makes his estimates and finds that the cost of the brick exceeds the sum of all *present* intentions. All the deliberations and dreams are to be rubbed out, and the plan redrawn on a smaller scale. This thing figures up all right and the new shop is built accordingly, and when done everything is satisfactory and the memory even of the big drawing fades away.

* * * * Two short years and prophecy asserts itself. Something is to be added, and a review of the old drawing shows that the very item was borne in mind but discarded on the final decision. The shop is built however, and the new item *must* be added. A long planer, or a big lathe, or a crane, or another cupola, or room for more patterns, or a paint shop, or a sand shed, or a flask yard, or a wood shop, or a forge or something must be wedged into a space already calculated with economy.

A few years shows added buildings shutting out light from the original ones; floors with jumping-off places at the most unexpected points; little machines peppered in among big ones; cranes which either lap or fail to connect; line shafts at angles driven by belts turned over mule pulleys; crowded areas originally intended for setting up floors; castings piled wherever luck has left room for them; patterns piled where luck has left no room for them; vises at windows far from the setting up spaces; shaving shops to leeward of foundry and blacksmith shops; and so many other things awry and disordered that the presiding genius, his own architect, wishes he was back in the old shop so that he could build the new one to suit the present demands.

* * * * I honestly believe, Mr. Editor, that the question of shop architecture will some day receive the attention of some of your readers who are willing to give their experiences; and that some one will suggest that elastic shop which can be built with present funds to suit present needs, and at the same time be capable of systematic extension in pursuance to a contrived plan. Making a new drawing on a smaller scale is wrong in principle. The scale of length only should be altered.

* * * Very Respectfully,

Chordal.

The beauties of competition were well illustrated by the experience of a New England felting mill, who bought a steam boiler about two years ago at a lower price than a well-known firm could afford to make it for. The boiler they purchased had braces fourteen inches apart. This was all very well while the boiler was new, but, a few days ago, the firm who failed to get the original order were made happy by the receipt of an order to insert an additional brace between each of the other two.

Shop Kinks.

No. 9.

A HANDY DRILLING JACK.

By L. F. Lyne.

In making repairs and in putting up new work about factories and shops, it often becomes necessary to drill holes in places where a ratchet cannot be used. On the other hand it is frequently desirable to drill thin material, or use a drill of a diameter too large for use with a breast drill. The practical mechanic will readily appreciate these and similar emergencies. The illustration, shown herewith, represents a very convenient drilling device, which has been used to a limited extent, but not as general as it deserves.

This device may be held in a vise or bolted to a post or any other convenient place. It may also be attached to different parts of engines and machinery. It is very simple and may be easily made, consisting of the knee *A*, made of flat iron, having a boss *D*, at one end. This boss is bored and a thread cut for the reception of the sleeve *E*, by which the drill spindle *C*, is supported, being adjusted by the handles *F*. The sliding bracket *B*, is easily adjusted by a pin placed in the holes shown. The holes are far preferable to notches or a key as there is no danger of slipping. The bracket is prevented from springing or getting out of shape by the projection *H*. When adjusted it is surprising how rapidly a hole may be drilled as the drill has a rapid and continuous rotary motion communicated by turning the handle *G*. I have known one of these tools to pay for itself in a remarkably short time; and every jobbing shop should have one, as well as all other establishments where a drill press is not available.

Pumping Machinery.

No. 5.

By Chas. A. Hague.

The last paper closed with remarks concerning compound engines with receivers of considerable capacity. Compound engines are also designed with as little waste room between the cylinders as possible, evidently with the main ideas of accomplishing the expansion of the steam, by a method calculated to prevent the existence of the highest and lowest extremes of temperature in the same cylinder, and to effect the uniform distribution of pressure, a moderate portion of the expansion taking place in each cylinder. Thus (neglecting the waste room), if steam expands to four volumes in the first cylinder, and to five volumes in the second, a total expansion of twenty volumes is obtained, with a difference in temperature due to only five volumes at the most, which (five volumes) would be a fair grade for single cylinders.

The piston to which steam is first admitted encounters some "back pressure" in the early part of its stroke, before the expansion in the large cylinder has reduced materially the pressure in the intermediate chamber, so that at low grades of expansion, say four or five, the mean effective pressure would not quite equal that in a single cylinder working the total grade of expansion; but, for high grades, the economy of heat resulting from two moderate expansions in conjunction, together with increased effect on the pistons, and other incidental effects, present some advantages in comparatively slow-moving engines in value of total work done. In compound engines without receivers (that is, closely connected between the cylinders), the storing of energy in moving parts is quite as important as in single cylinder engines; and even where receivers are used, if the grade of expansion is high, the "balance of power must be carefully controlled."

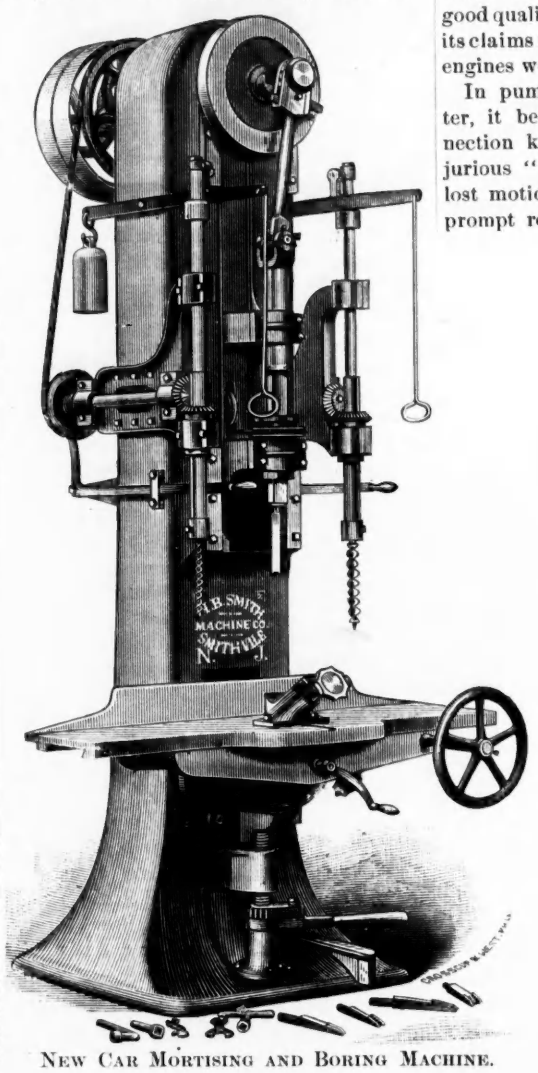
Having briefly considered the distribution of the energy of the steam uniformly throughout the stroke, without regard to any special application of the power devel-

oped, it may be well to glance at three of the most important adaptations of steam engineering, and observe how the conditions gradually narrow down in the different instances. In mill practice where there is no limit to either speed, or piston, or rate of rotation beyond the safety and endurance of the engine itself, single-cylinder engines of comparatively small sizes may be constructed and operated, in a manner that will furnish adequate effectual distribution of the energy realized from the conversion of heat. In this field it has not yet been made plain that the compound engine can successfully enter into competition.

In marine practice where the demand comes for maximum power with minimum space and weight, and where the rate of rotation is somewhat limited, the tendency is towards large cylinders and short strokes. This peculiar proportion of cylinder and the different questions in regard to valve gear and steam expansion which accompany it, naturally lead to the practice of compounding; though some claims have been made by builders of high repute, that they can do equally well in the line of high grade expansion by the employment of single cylinder engines.

The third class brings us more directly to our subject of pumping engines, and in this line of practice the demand is most emphatically made to "go slow." A fair speed for pump plungers is not far from 200 feet per minute, and where the connection is directly made between piston and plunger, of course the piston speed is necessarily reduced to this low figure. Where moderately long strokes are employed, a very low rate of reciprocation ensues; the result of which is, that when economy of steam is sought through high grades of expansion, the great length of time during which the steam is confined in the cylinder renders it very necessary to maintain the heat of the iron fully up to that of the initial steam, and to be certain that the steam shall never become over-saturated.

A high grade of expansion in a single cylinder engine, when the rate of reciprocation is very low, would result in a very unequal distribution of energy, and this inequality would be entirely too prominent to admit of the safe operation of a pump delivering water into a force main. The only recourse under such circumstances would be to follow the old plan of making the machine of double the necessary capacity, and working it "single acting," the work of the steam being expended in lifting a weight during the suction stroke of the pump; the fall of the weight, almost perfectly uniform in its effect, giving out its potential energy, and thereby forcing the water out of the pump. By this means the unequal work exerted by the initial and expanding steam is not felt by the water column. A well-known arrangement of compound engine, is one in which the small or high pressure cylinder is placed directly in front of, or behind the large or low pressure one, and the steam passes from the front or back end, as the case may be, of the small cylinder to the opposite end of the larger. It is largely used in operating pumping machinery, and as thus applied presents some very superior features in the matter of uniformity of pressure, although *apparently* it can not be successfully operated at the higher grades of expansion, four or five seeming to be the limit. The principal features of this type of engine being to take steam as nearly as practicable during the entire stroke in both cylinders, the grade of expansion is determined by the proportionate areas of the pistons, and there is no unnecessary waste room in passing the steam from one to the other. The representative of this type of pumping engine has been one of the most successful known for water works purposes. It seems to be peculiarly adapted to the many arbitrary conditions



NEW CAR MORTISING AND BORING MACHINE.

governing the pumping of water under pressure. It is of the class known as "direct-acting," that is, the work of the steam is transmitted directly to the water column without the distributing agency of a balance wheel. The steam piston is secured to one end of a piston rod, and the water plunger to the other. There are no rotative parts, and consequently the distribution of steam energy throughout the stroke needs to be uniform to an extreme degree. The engines are arranged to work in pairs, in a manner similar to a pair of coupled engines, with cranks at right angles. The effect on the pumps is all that could be desired. Allowing a short pause at the end of each stroke, the pump fills perfectly, and the water valves seat themselves very quietly. The indicator diagrams taken from pumps operated by this style of engine are the most perfect ever produced by pumping machinery. The economy of steam exclusively, is not carried to an extremely high point, but the power developed is nearly all applied directly to the work to be done. With the moderately high duty obtained, low first cost, inexpensiveness of foundations and freedom from stoppages and repairs, this engine takes high rank, and if its builders can succeed in forming a compromise between its good qualities and a high grade of expansion, its claims to everything desirable in pumping engines would be pretty well established.

In pumping engines of a rotative character, it becomes necessary to keep the connection keys up pretty close to prevent injurious "pounding," and this absence of lost motion at the centers results in a very prompt reverse of the plungers at the ends of their strokes. At this point the energy stored in the balance wheel is irresistible, by virtue of the crank's position, and thus the load is "picked up" suddenly, as is demonstrated by the water diagram taken from the pump.

Fig. 1 is a fac-simile of a number of cards taken from a direct-acting apparatus as mentioned above, and Fig. 2 is from a very large and well-built rotative engine.

Just what should be sacrificed for steam economy, and how costly in the average experience, the effect of this distorted water diagram really is, requires careful and unprejudiced judgment. Important matters bearing on the question, are mechanical conditions which must be satisfied in obtaining high steam economy; necessary forms and amplitude of machinery, foundations, buildings, etc., employed in satisfying these conditions; the proper relation between first cost and after expenses, besides other incidentals.

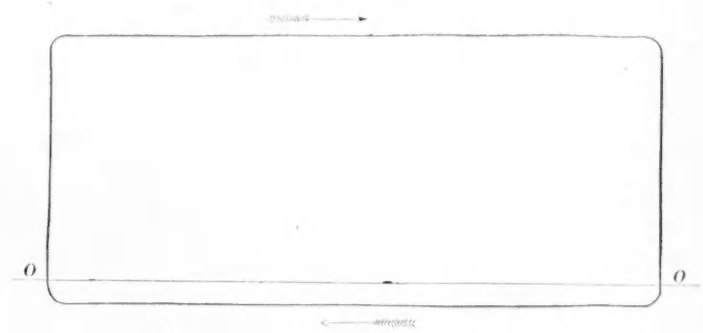


Fig. 1

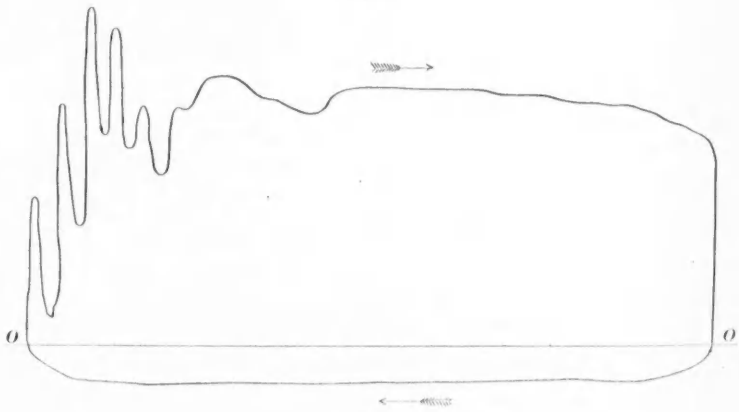


Fig. 2

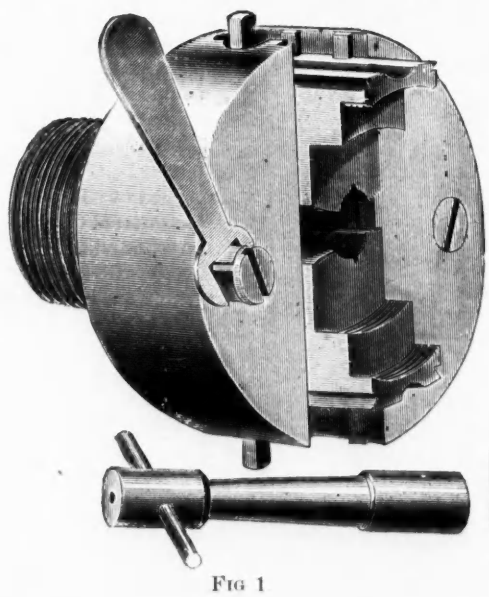


FIG 1

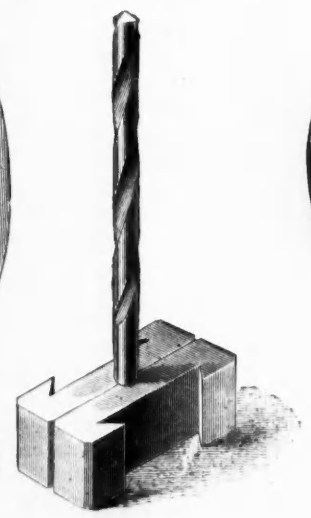


FIG. 3.

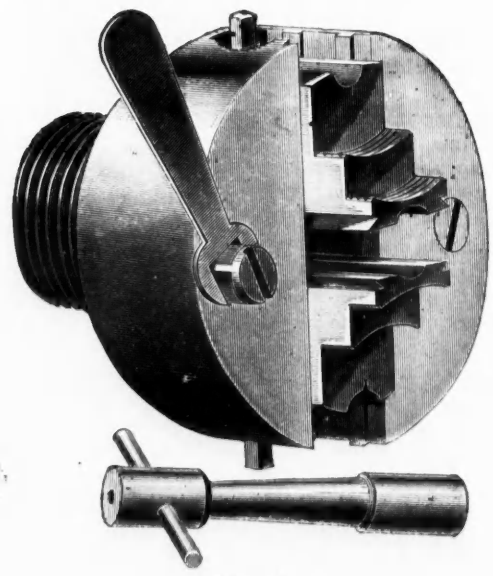


FIG. 2.

Combined Lathe and Drill Chuck.

The cuts on this page represent a new lathe-and-drill chuck, which possesses some peculiar advantages. It has two jaws which are moved by means of a right and left screw. These jaws are made so that they can be reversed. When placed in the chuck as shown in Fig. 1, they will hold work from 3½ inches diameter to ⅛ inches. For small work and for holding drills it is more convenient to use them as shown in Fig. 2, the position of the jaws being reversed. Fig. 3 represents a pair of false jaws which slip on the end of the other jaws for holding very small work or drills. These false jaws are made of steel, and when wanted for holding special work they are furnished soft, so that they can be filed into any shape required. This chuck is strong and well made. It will hold a drill with a shank from ⅛ to ¾ inches diameter and with sufficient force to drive a drill, cutting a hole one inch in diameter. The chuck will probably be a favorite for small work. Goodnow and Wightman, 176 Washington street, Boston, Mass., are introducing this chuck to the public.

New Car Mortising and Boring Machine.

The machine represented by the cut on this page, and made by the H. B. Smith Machine Company, Smithville, N. J., is intended for the heaviest car work, and will make a 2½-inch mortise through a 12 x 12 inch stick of timber.

The head stock, carrying the crank shaft and chisel bar, is fed down to the work by power, and has a quick-return movement.

Power for this purpose is taken from the crank shaft, a lever at the base of the machine serving to apply the power for starting a screw in either direction, for raising or lowering the head stock. The head stock is stopped automatically when it reaches its highest point, and an adjustable cam is provided for limiting its downward motion; so that the chisel may be made to penetrate any desired depth to six inches, an index on the frame showing to what depth it is cutting.

Continued on page 7.

A Compression Shaft Coupling.

As the shaft-coupling subject has lately been agitated considerably in our columns, we present herewith cuts of Kline's Compression Coupling, which differs in some respects from those previously referred to.

Fig. 1 shows the coupling as on the shaft, complete and ready for use.

Fig. 2 shows the coupling in parts, as seen detached from the shaft. The pins in the wedge-shaped or internal part of the coupling are made of steel, fitting closely in corresponding holes in the abutting ends of the shafting. The cone, or wedge-shaped pieces, are bored a little apart, giving them room to compress tightly on the shaft as the shell is drawn on them by the bolts, which run lengthwise through the coupling.

The cuts give a good idea of the application of this coupling. It is compact, and holds the shaft very firmly. It is not affected by the shaft getting out of line, as the shaft must bend at its weakest point, and the coupling holds it with a stiffness at the joints greater than at any other point. This coupling is made by E. Dennis & Co., Jackson, Mich.

A New Emery Grinder.

The accompanying cut represents a new emery grinder, called the "Letter G," manufactured by the Tanite Company, of Stroudsburg, Penn. Hitherto, among the great variety of such machines, very few have been built to carry exclusively one large wheel. In machines which carry two wheels, there is a certain amount of difficulty in providing solid and convenient rests at the sides of the wheels. This is due to the fact that the emery wheels overhang the bearings. The special object in designing the machine here illustrated, the manufacturers declare, was to make it equally convenient to use the wheel on the face, and on the side. In machines previously built, the *side* rests were attached to rest sockets, and several nuts had to be carefully adjusted before the rests could be secured in their proper position. The "G" grinder is designed to carry an emery wheel of 20 inches diameter, and of any desired thickness, from one to four inches; 20 x 2½ or 3 inches is the most suitable size. The front of the machine stands at such a height that the rest *C*, when laid upon it, brings the metal which is to be worked exactly at the center of the emery wheel; which is the proper point of contact when the face of the wheel is used as the cutting agent. The rest *C*, is of cast iron, and is 20 inches long by 8 wide. It is shown in the cut as being faced with a steel plate (saw steel), which was the original method of making these rests; but, since the introduction of the "Newman Emery Planer," all of these rests are accurately faced with a Tanite wheel running on an emery planer. The back of the machine stands 5 inches higher than the front, and on the brace rod *D*, which connects the upper back corners of the side frames, swings the rest *B*, depending for its rear support on the brace rod *D*, and resting in front by a foot on the rest *C*. It bridges over the side flange of the emery wheel, and being a wide, long, substantial rest, allows of work being conveniently held and ground on the flat side of the emery wheel. Owing to the weight of this rest *B*, it remains firmly in position without being held by nuts or set screws, and as it swings loosely on the brace rod *D*, it can in a moment's time be moved out of the way and be left hanging down at back of the machine, or lifted up and placed in position.

The spindle of the machine is of steel, and is 1½ inches diameter at eye on mandril hole of wheel. The bearings are long, and are lined with babbitt metal.

Wm. O. Webber, who wrote an article for the Jan. 22d issue of the AMERICAN MACHINIST on the Shading of Drawings, has been appointed superintendent of the Allen Paper Car Wheel Works at Pullman, Ill. He has until now had charge of the testing department of the Chicago, Burlington & Quincy Road at the Aurora shops.

Explainable and Unexplainable.

By F. F. HEMENWAY.

There are some things a man will do that can't be explained by any known process of reasoning. You can't get them into line with any natural, or physical laws, and you set them down as unexplainable.

A man doing business in a locality where he must pay seven dollars a ton for coal, will buy a 100 horse-power engine, full stroke valves, and ports the whole length of the cylinder, and go right along, evaporating fifty pounds of water for every horse-power he uses, and thereby throw away ten dollars a day; that is, if he makes enough at his business to pay coal bills. He might save that ten dollars a day and retire from business in a few years, or, he might devote it to charitable objects; or he might set it

Fig. 2.—COMPRESSION COUPLING DETACHED.

apart for the special missionary purpose of spreading mechanical knowledge amongst the attachés of the daily press, in which event he would deserve a monument from an enduring public. (I mean the particular attachés who graphically describe accidents to and by machinery); or he might squander it in any decent way, and it wouldn't be any one's business but his own.

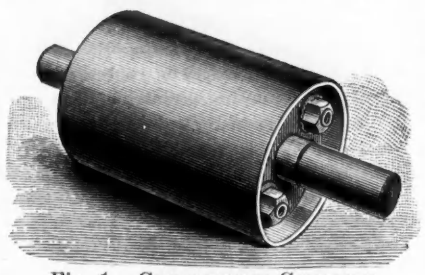


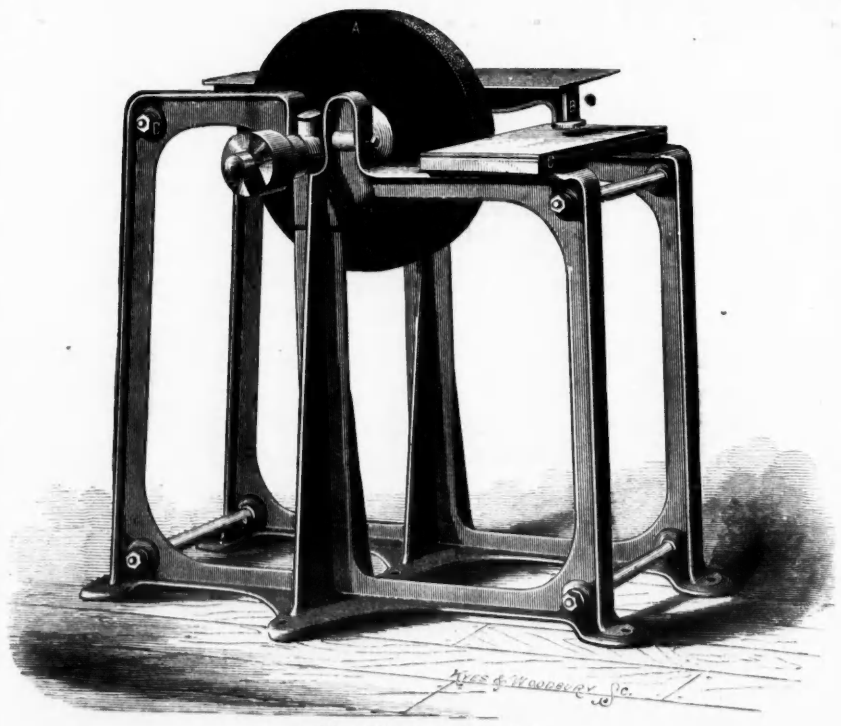
Fig. 1.—COMPRESSION COUPLING.

pay one man's time, two days in the week from the nearest machine shop to keep things in running condition, and you can't begin to explain why he does it. If these parties were to swap equipments you could argue for the change. If they keep right along as they are it is their own business. If they swap it isn't any other man's business.

* * * * * * * *

It is explainable why a merchant keeps his stock of shop-worn, out-of-date goods worked off,—sold at any price. He can't put his unsalable commodities into the cupola and get good stock from the tap hole. He does the next best thing. He sells them for what good money they will bring. His course is explainable and it don't need much explaining.

Nine-tenths of the machine shops in the world are half-filled with broken pumps, worn-out gears, pulleys without arms and pulleys with cracked arms, old hangers and defunct safety valves. Why these things that never will be used, or never can be used, or never ought to be used, are cherished,



A NEW EMERY GRINDER.

Yet, it isn't anybody's business, if he burns it under his boiler. That same man will hire a first-class engineer, and wear him out shoveling coal; and disable him cleaning fires; and discourage him, trying to make steam enough to supply a constant connection between the boiler and the atmosphere, and raise his wages to keep him.

He will burn out old boilers and patch up new ones, and keep a foundry running on grate bars. You know he is doing these things, and you see how he does them, and you understand when and where he does them, but you never know, nor see, nor understand, why he does them. Another man doing business where he has to hire carted away what combustible he can't burn, will buy a high-toned automatic engine and hire a laborer to run it, and wear him out trying to do what he was never educated to do, and what he can never learn to do, and he will and given valuable shop room without paying rent is one of the things that can't be explained. No living man will ever be able to explain why two-thirds of the available erecting room is pre-empted by pre-historic steam engines, crippled washing machines, and useless potato diggers; and why these are kept fifteen years and then moved outside to hold up and push over the walls, and to make room for steam engines a little more pre-historic, and for washing machines and potato diggers a little more crippled and useless. The average proprietor will refuse four hundred dollars for a second-hand steam engine, set it right where every man will go around it, and crawl under it, and climb over it for ten years, and at a cost of fifteen hundred dollars, and then sell it for two hundred and fifty dollars, if he can get two more to put in its place. More than this, he will figure a clear profit from the transaction. You can't explain it, and he won't explain it. You know he has lost two thousand dollars, and he—well, he does the same thing the next opportunity, and when you own a machine shop, you'll do the same thing, too.

* * * * * * * *

There is nothing particularly fascinating in a piece of pine lumber, or captivating in putty and black varnish; but when you combine them with a certain amount of skilled labor, and christen the combination a pattern, it gets right hold of the affections of the machine shop proprietor. If a machine shop and foundry are connected, and run on general jobbing, and have the upper story of a forty acre lot for a pattern loft, it is only a question of time when the peace of mind of every responsible party in the establishment will be endangered. Nothing is ever burned up, or split up, or worked over into something else, after it has passed through the hands of a pattern maker. Its initial cost may not be much. It may be morally certain it will never be used again; but it is more certain it will be laid away in some corner of that loft, and be housed and protected, and have its rent paid, and add its quota of insurance and taxes, and hide some pattern that is used, and it is beyond human skill to estimate its terminal cost. That pattern loft will be started on a small scale, and it will grow spasmodically, and irregularly, and unsystematically, into something without "form or void," with its concomitant "darkness." Its ultimate end will be a condition of angles and alleys, passages leading everywhere, and passages leading nowhere; and it will require a special pilot to navigate it, and he can't find much that is wanted; and there is not another living man that can find anything. Useful patterns get swallowed up in its chaotic labyrinth, and they get duplicated once a year, and help along the demand for more room. Every man connected with the establishment knows that three-quarters of the patterns saved ought to be destroyed as soon as used, but there isn't one man that can explain why they are so tenderly guarded. Every man connected with the establishment knows that to clean out the whole loft of its unnatural accumulations, burn up nine-tenths, and arrange the rest on a *finding* basis, would be equivalent to a big increase of capital, just as well as he knows it never will be done, and just as well as he knows he can't tell why it never will.

* * * * * * *

There isn't an institution that dies as easily, and as naturally, and as regularly, as a machine shop. There isn't anything mysterious about it, and it isn't a dispensation of Providence. No man has ever thought of the matter fifteen minutes but he could explain *how* it is. It would exhaust the resources of a National Commission to explain *why* it is. An individual, or a firm, or a corporate body will start out in engineering and machine business, and they will stock up with the best modern tools; strike a good line of work and make money; but it is one of the peculiarities of the business that twenty years double the efficiency of the line of machine tools that ought to be employed to produce certain effects. The lathe that is all right to-day will be all wrong twenty years from to-day, and the planer and the slotter and the milling machine that are the best now won't have an honest standing in the shop in twenty years. Will that individual, or that firm, or that corporation, have the moral courage ten years from starting to put that planer that is just right now into the cupola, and the next year will they follow with the slotter and the milling machine, and so from year to year will they turn out old ideas and turn in new ones? Not much they won't. Their tools are associated with the idea of making good machinery, and money in the past. They are associated with their start in business and they are old friends and tried friends (too much tried) and they stick by them. They have been gradually and imperceptibly getting worse, and corresponding products have been gradually growing better, and the

difference can't be appreciated. If these changes came in the nature of an earthquake it might be different. No, they will not. They will work over them, but they won't work them over. They will humor them, and nurse them, and try to fasten improvements upon them. They will dress over the planer cross heads, and make new uprights, and tables, and tool posts, and make new pulleys for wider belts. They will bore out the boxes and put larger spindles in the lathes, and alter the feed gearing and by and by they will change the cones to fewer changes and wider belts. They will do all these things and a great many others, but they won't do the only practicable thing—break them up altogether. They find competition crowding them and they get a faint idea that their tools are not earning as much as those of other concerns that are starting in with modern appliances, and they rebuild them some more and stir up their help and lose money. Then they get out while there is something left, or they fight against fate till the idea strikes them, like an inspiration, that they need what they can't get and what they might have had two or three times over—an entire new outfit.

LETTERS FROM PRACTICAL MEN.

Dry Horse-Hide Belt Lacing.

Editor American Machinist:

Seeing the communication of Albert Baker on the subject of lacing belts, reminds me of a case I had in hand a few years ago. It was an 8″ belt, in which it seemed to be impossible to make common lacing or hooks do their work. After being troubled enough, I thought I would try what "virtue" there was in horse hide. I obtained a horse hide, dry, hard and untanned. I gave it a few hours' soaking in the mill race, until it was soft enough to cut; then cut the string from it. To make it pliable I took the strings by each end, and "sawed" them over a square-cornered iron until soft and pliable enough to sew. I then sewed my belt with the hair side of the string inward, the first time across, and outward on the finish. The result was I had the hair to take the wear. After the string had dried it was as solid as any hooks, with this advantage, it could not unhook. It did not wear out, and it did not cut out the belt holes. To my knowledge, that lacing run six years, and how much longer I don't know. If any of your readers have trouble with belt lacing giving out, especially in damp places, I would advise them to try it. I would like to ask Mr. Baker how fast he run his wire lacing, and what sized pulleys it was on. Had he tried it on a cylinder planer pulley about 5″ diameter, making some 3,500 to 4,000 turns per minute, it would have given it a good trial.

CLINTON.

Springfield, Mass.

An "Arkansaw" Engine Test.

Editor American Machinist:

DEAR SIR.—I cannot resist the desire I have to let the mechanical world know what is going on in a corner of "Arkansaw." The whole thing is very amusing to me. An engine was on exhibition in this city with steam on, a few weeks ago, and I was invited to see it. I took a look at it, and as soon as I got an opportunity I slid out the alley door and left, fearing I would be called upon for a testimonial. I did not want to refuse this on business reasons for the house I am with, and on the other hand I did not wish to give one, and thus "write myself down an ass" before the mechanical fraternity of this country. However, I did not escape, as the party owning the engine wrote a few days ago ordering some goods and requesting me to give a testimonial, which I did in as mild a form as possible. (This leads me to think that I would like to hear from some of the writers for the A. M. on this testimonial business in general.) This engine is nothing but an oscillating pattern in which the oscillations of the cylinder open and close the ports. The cylinder has a boss cast on one side through which are cored the ports, with a chest with corresponding ports held up against this face on cylinder by a spring. The reversing is done by a valve changing the steam from one set of ports to the other, the same as all Otis elevators and engines of this class.

I must give you the test this engine was put to as described by the owner. We will call it the "Arkansaw Steam Engine Test." This engine was connected to a line shaft on which was also connected an old slide valve engine of about the same size, both taking steam from the same boiler. The engines were set to run in opposite directions and steam turned on. Result: Quite a struggle for a time; at length the old slide valve succumbs, the whole town is elated, and orders are booked for 20 engines at once.

J. W. H.

St. Louis, Mo.

A Pair of Queer Indicator Cards.

Editor American Machinist:

Having been a reader of your valuable paper for some time, I have become greatly interested in your column headed "Letters from Practical Men," and as I have not noticed any letters bearing directly upon indicator diagrams (a subject upon which I am heartily interested), I thought I would send you a specimen of a pair of, to my mind, very queer cards.

The enclosed cards were taken from a 10″ x 30″ Harris-Corliss engine, which was running the shop where I am employed.

The fact which makes them queer cards is, that they were taken almost simultaneously, with a difference of only three revolutions between them.

The card shown in Fig. 1, is the first end, Fig. 2, the back end of cylinder. At the time of the "taking" I requested the foreman of the machine shop to be so kind as to have the heaviest casting, which was in the shop, placed or suspended from a 15-ton Yale Lock traveling crane, so that we might see how the engine was working under such a load.

From Fig. 1, it is evident that the load was gradually increasing, as may be seen from the three different lines on the curve, while on Fig. 2, which was taken three revolutions later, the load was suddenly placed entirely on the engine.

I send these specimens to you only as representing a queer pair of simultaneous cards.

F. A. SCHEFFLER.

Providence, R. I.

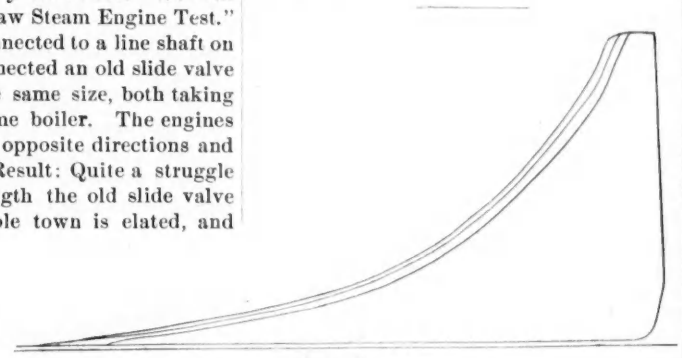


Fig. 1.

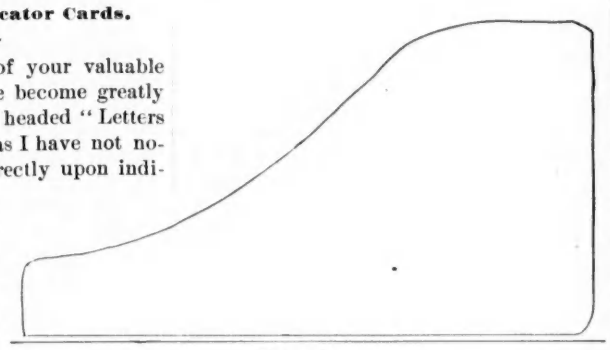


Fig. 2.

Some Reasons for Crooked Threads on Pipes.

Editor American Machinist:

In a recent article I attempted to show how straight work might be made, with crooked threads on fittings, and pipe; but it is plain, that when a man has to resort to such means he is making the best of a poor job, and that he would prefer straight threads, except when he required his work a little "out of square." I will now try and show some of the reasons why threads on pipes are not always as straight as they should be, which may also suggest a remedy.

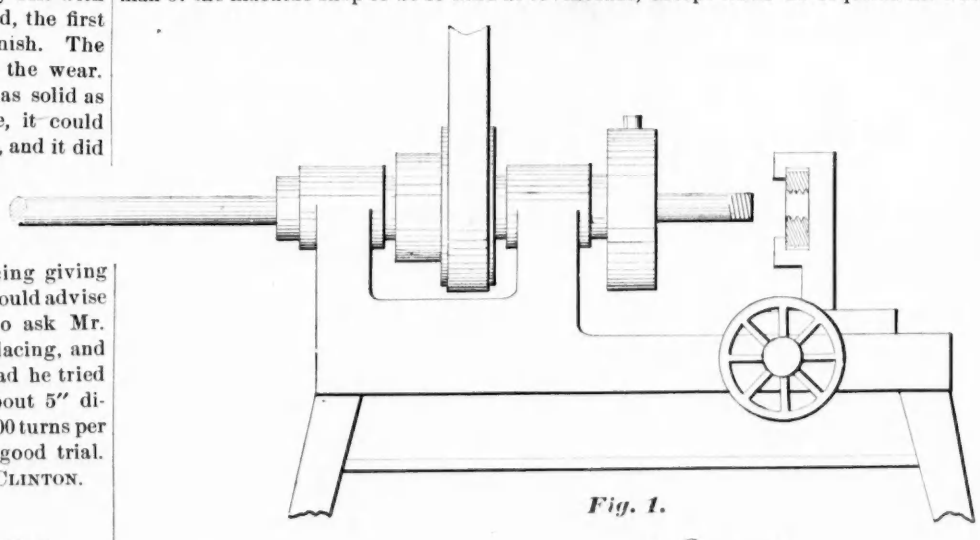


Fig. 1.

Fig. 2.

PIPE CUTTING MACHINES.

It is known to manufacturers of pipe-cutting machines that a pipe *revolved against a die* is more apt to give a straight thread than a *die revolved against a pipe;* but to the person who has given the subject no consideration, it will appear, at first thought, to make no difference.

In the ordinary old style of pipe-cutting machine (the simplest form of which is shown in Fig. 1), the pipe is passed through a hollow arbor in the head of the machine, and grasped in front by reciprocating vise jaws, with the assistance of a bushing at the back, for the different diameters of pipes, giving the pipe a practical center in the arbor. The die is placed loose in the carriage of the machine, although it is sometimes bolted to it; but for the present we will only consider the loose die, slipped into the carriage, and allowed to center as best it can; being pushed into place by the pressure against the pipe, when it will take a position at right angles to the axis of the pipe. In these machines the pipe is revolved, and the die is stationary, and it stands to reason that if the pipe is straight, and in the center of the revolving head, the thread must also be straight. But how will it be if the die is not quite at right angles; that it has small chips between it and the carriage; and that the pipe is not actually in the center of the revolving head; that the threads which actuate the jaws are worn, or the back bushing is not a good fit? For small differences it matters not. If the die is true in the machine, and the pipe untrue in the head, the pipe will wabble, as it screws into the die; but as the eccentricity bears no set relation to the die, but goes all around it every revolution, the die being free to move sidewise, the thread will be true with the axis of the pipe, and the shape of the V of the thread will not be spoiled if the die is not held firmly to the face-plate of the carriage after the pipe has turned twice or thrice into the die. Should the pipe and the die be both a little out, the thread will still be true with the axis of the pipe, but the V of the thread will not be perfect; still, for practical purposes, it will do, more especially when the thread is not coarser than on a two-inch pipe thread (11½ to the inch).

When the die is bolted firmly to the carriage of the machine, and is truly at right angles to the axis of the arbor, and the pipe a little out within the arbor, the thread will still be true with the axis of the pipe, but the V of the thread will be distorted.

In a machine where the die is in the head and revolves, while the pipe is clutched firmly opposite it, if the pipe is true and the die true, the thread should be true also; but if the pipe, from being a little crooked of itself, or through carelessness in chucking, or from the practical impossibility of holding a pipe 20 ft. long, and getting it straight one time in four with one pair of jaws, hangs down on the overhanging end, it cannot have a straight thread. The relative position of the die to the pipe is always the same (on the assumption that the die runs true), and whatever the pipe may diverge from being true to the axis of the machine, just so much will the thread be crooked. In such a machine, the principle of which is shown in Fig. 2, the result of a wabble in the die will be to alter the shape of the V of the thread, but will not affect the position of the thread to the axis of the pipe.

The common stock and die works on the principle of the machine when the die turns, and when the guide bushing of the stock is large, it is next to impossible to push it on straight.

If a pipe is not cut off straight, the die will take hold of the long side of the pipe first, and draw itself on crooked, consequently it will be difficult to make a straight thread in any machine, if the pipe has been cut badly, as it often is with a hand cutter.

The foregoing may not be quite clear to some, but it may be the means of putting them upon a train of thought, which will work its own solution. A pipe machine with a non-revolving die, set at right angles to the axis of a revolving hollow arbor, will cut a practically straight thread on a pipe, whether the pipe is in the center of or parallel to the axis of the arbor.

Perhaps the complaints of the crookedness of original threads on pipes (the manu-

facturer's threads) can be traced to the fast cutting machines, on the principle of the revolving die, now so much in use. There is certainly ground for complaint in this respect, and manufacturers should pay some attention to it. Wm. J. Baldwin.

N. Y. City.

Do Stays Stay?

Editor American Machinist:

Perhaps no explosion within a limited number of years, unattended with loss of life, has provoked more speculation from professionals, as well as the laity, than that of the McCreery & Co. boiler of New York city, on Jan. 16th. Many ingenious theories have been advanced, which are profitable, so far as they lead to investigation and experiment; but when, as in some cases, present systems of management are condemned, and radical changes suggested in the construction, setting, etc., of boilers, they should be received with extreme caution. Take for instance a theory which has appeared in some of our technical journals, to this effect:

The dome stays being set obliquely, and passing from a point in the cylinder of the dome, 11 inches from the top, to a point in the top plate or crown sheet 7½ inches from the edge, it is assumed that as the temperature of the stay increased it would expand in the direction of its length, and, acting in conjunction with the steam pressure instead of in opposition to it, would have a tendency to lift the dome plate in the region where the stay was riveted up. As each stay would have the same action, there would be a general rise and fall in the central region of the dome plate, as the pressure and temperature increased and decreased, which would, of course, create a breaking tendency around the edges. A partial compensation for this is acknowledged however. The stay is said to be 15 inches in length, while the lower end joins the cylinder of the dome 11 inches from the top edge of same. Now this perpendicular surface is allowed to have a certain expansion; but as 15 is to 11, so is that of the stay to that of the side of the dome. Hence, by the amount of expansion in 4 inches will the stay push against the upper plate. It is claimed, therefore, that the stay will not fulfill its legitimate function of a stay until it has assisted the steam to deflect the top plate to the extent of the excess of expansion, namely, that of the 4 inches.

At first sight this reasoning seems plausible, but let us examine it on all sides before receiving it too readily. While taking into account the expansion of the stay and the perpendicular surface of the dome, this hypothesis seems to overlook entirely the fact that there is an equal proportionate expansion of the upper horizontal plate. Why this should be ignored is unaccountable, but that it does exist is self-evident and needs no demonstration. Now take as an illustration a right-angled triangle. Let the horizontal side be 12 inches, the perpendicular side 16 inches, and the hypothenuse 20 inches in length, and let these parts represent respectively a section of the crown sheet of dome, a section of the side of dome, and the stay. The dimensions are increased for convenience, but the increase will only make the deductions of the above theory more evident, if they are true at all. Let us suppose now that there is a general expansion by heat taking place of 1 inch to the foot. The dimensions of the triangle will be: Horizontal side, 13 inches; perpendicular side, 17⅓ inches; hypothenuse, 21⅔ inches. Adding the squares of the two first dimensions, and we find the sum equal to the square of the 3d dimension. Hence, the triangle is still right-angled and unaltered, yet each has suffered its natural expansion. If any further demonstration was necessary, we might take a solid piece of iron, say 6×4×1 inches in dimensions. Bring this from a cool state to the temperature of highly-heated steam. Our triangle will be represented in this piece of iron, and the hypothenuse will be found in a line running diagonally across and through the iron. This section of this piece of iron is subject to precisely the same influences as the stay in the boiler, and if the hypothesis referred to is correct, the right angles will be forced into obtuse angles, and the sides will describe the arcs of a circle, a phenomenon which is not borne out by experience.

The remedy recommended for this unequal expansion is to make the stays longer, thereby reducing the angle at the foot and bringing it nearer to the perpendicular. So far as it acts more nearly in a direct line with the resistance to be overcome, this would, doubtless, be an improvement; but would it remedy the evil complained of? Supposing for an instant this evil was a real one, let us see if a longer stay helps the matter any. If there is any upward pressure of the expanding stay at a greater angle, there must be some upward pressure at any angle, however slight. As there is no "loss of motion" here, the slightest upward tendency, even though the excess of expansion over the side sheet be the infinitesimal part of an inch, will make itself felt with almost equal force between two unyielding surfaces, as when the discrepancy in expansion is greater. *Reductio ad absurdum:* this supposed action of a stay can only be avoided by reducing the angle until it is lost in the side sheet of the dome, or becomes a longitudinal one entirely, all angled stays being a source of weakness instead of strength.

Then, again, there is the supposition that the boiler ruptured at about 55 lbs. pressure. In view of the hydrostatic test, only 5 months before, of 105 lbs., a safety valve set at 60 lbs., and a daily working pressure of from 40 to 50 lbs., which probably sometimes ran up to 60 lbs., it would seem that this would be hardly a tenable position. As the defect in the sheet was undoubtedly caused by flanging, there would be no good reason that we know of why the defect should be worse at the time of the explosion than when the boiler was put together.

Neither is it necessary to raise the theory or rather no theory of a "mysterious explosion," whereby through the "mighty magic" of some hitherto undiscovered agency, a boiler is suddenly wrecked, and no one knows why or how. There are several ways that the explosion may have been brought about, without hunting up a reason outside of the common and well-settled conditions, which we know can and do cause explosions. One of these is too little water, and another is too much steam. Safety valves

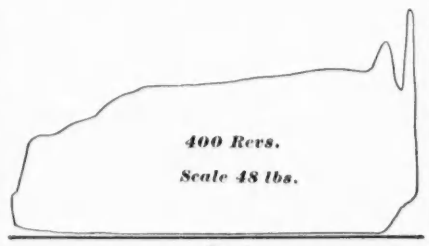


Fig. I

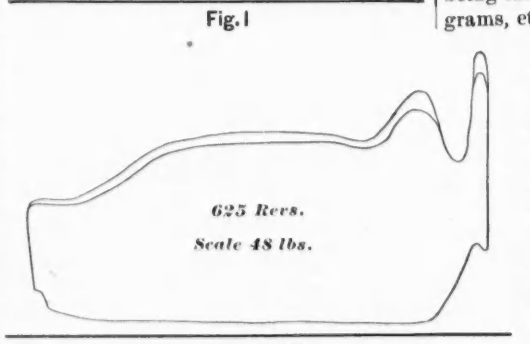


Fig. 2

are not always infallible, but sometimes stick, or have their weights accidentally moved out. Feed water pipes, and their connections, sometimes spring a leak, letting the water slowly out of the boiler. Steam gauges, glass gauges, even try-cocks sometimes tell false tales. Boilers under defective sidewalks are liable to a sudden dash of cold water from above, or the slower but not less sure "constant dropping," causing unequal expansion and contraction, as well as erosion. Engineers also, alas! are still mortal and liable to make blunders, like the rest of mankind, and do not always remember such blunders distinctly enough to report them. However, in view of the meagre data furnished so far, would it not be well to ascribe the explosion to some such common cause as the above, until there is indubitable proof to the contrary.

A. H. Crawford.

Liverpool, N. Y., March 9, '81.

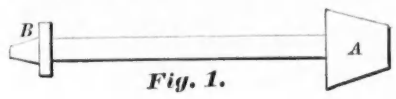


Fig. 1.

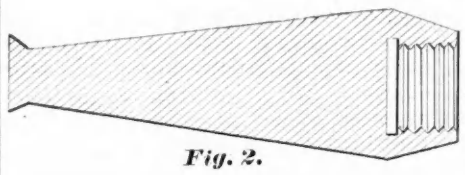


Fig. 2.

Chucking a Peculiar Piece of Work.

Editor American Machinist:

I find the sketch of the job I wished some of your readers to state how they would chuck was omitted in my last letter, in March 19th, issue. This omission I now supply and add another example. Figure 1 represents a piece of cylindrical work turned true and requiring to have at its end *A*, a taper turned and threaded *dead true* and quite parallel with a coarse pitch left-hand thread, to be cut with single pointed screw tool. Figure 2, also represents a piece of work to be chucked and similarly threaded with a dead true thread and quite parallel with a left hand thread at end *A*, end *B* having a taper, say three inches long. Both pieces have a total length of, say, eight inches. In my letter in March 19th issue, Fig. 1 should have been Fig. 2, and *vice versa*. Fig. 5 should have been designated "shaft coupling." Joshua Rose, M. E.

New York.

Engineering Notes.

Editor American Machinist:

The extremely high rotative and piston speeds, to which the modern steam engine seems tending, naturally suggest the question whether speeds are not possible, if such speeds have not already been reached, that outrun the range of the indicator as a useful instrument.

That there is a limit to the number of responses an indicator spring and attachments, however light, will make per minute, to widely varying steam pressures and tell the truth, there can be no question, and if one will take the trouble to analyze the causes which produce distorted diagrams at high speeds, he will soon convince himself that some engineers are getting dangerously near the speed line, beyond which one cannot go with an indicator and get results at all satisfactory.

Engineers are sometimes pleased to talk about the momentum of the moving parts as being the disturbing cause in distorted diagrams, etc. If that were all, the high speed problem would be comparatively simple. There is, however, a greater difficulty in the way, viz.: that of energy which increases with the square of the velocity, and makes an engine running at 500 revolutions per minute, just four times as difficult to indicate as one running 250, and sixteen times more troublesome than one running 125. In another light it looks this way:—assuming the recoil spring in the paper drum to have uniform tension through its whole rotation, a diagram 2½″ long taken at 500 revolutions would mean one 10″ long at 250. This ratio of increase in the tendency of an indicator to fling seems startling, but it is a fact that is in our way and there is no use in attempting to dodge it.

The question that is disturbing us now is how fast may we run engines and correctly indicate them.

Two years ago 300 revolutions per minute was considered a pretty high speed, both for engine and instrument, but now engineers double that speed by count, and quadruple the difficulties in the way of indicating, and there is no evidence yet that a rotative speed of 600 is the outside limit. I have heard of one manufacturer in this State who is said to be engaged upon an engine that is to run 750 revolutions, and, I believe, wants it indicated. His hope will lie in a diagram of greatly reduced area, which is, in fact, our only chance at these great speeds.

I submit two diagrams taken with same instrument and spring from same engine with the simple difference in speed. The scale of the spring is $\frac{1}{48}'' = 1$ lb., size of cylinder, 5″ bore and 7″ stroke. The engine works steam expansively by means of a shifting eccentric on shaft, controlled by a governor. At the time the diagrams were taken the engine had sufficient load to work the valve nearly to its greatest travel which gave large steam ports—about ⅓ the area of cylinder. A close inspection of diagram No 1, shows it to be a very safe one for any purpose—each line well defined and just where it should be. While there seems to be but one diagram the pencil passed over the paper at least a dozen times.

Diagram No. 2, taken with somewhat higher steam pressure, and at a rotative speed of 625 revolutions, a little more than 50 per cent. greater than No. 1, is wholly worthless; not from any failure of the pencil movement to respond, however, but from tardy action of paper drum, stretch of cord, etc. Both were taken from the same point on reducing lath and should be of same length, but the higher speed shows a positive fling of ¼″, which renders what otherwise might be a fairly intelligible card utterly worthless. It would be interesting to know just where the fling takes place, and its influence upon the diagram. The compression line points clearly to a portion of it, and the release seems to point as plainly to the balance, but the question arises—if insufficient exhaust ports for that high speed may not, in a measure, account for the peculiar shape of the release. I am inclined to think it does. With a short, stiff spring in paper drum, I have taken diagrams from same size engine at 600, but the terminal pressure was so much lower that it furnished no clue to the mystery.

A comparison of the two diagrams will show how ready the exhaust passages are to rebel when too much duty is put upon them. No. 1 shows very little back pressure, while No. 2 is distressingly extravagant.

H. Tabor.

Corning, N. Y.

Mechanical Provincialisms.

Editor American Machinist:

Will you do the rising generation of mechanics the favor to warn them against contracting the habit of using what I will designate as "Mechanical Provincialisms?" The principles of mechanics are universal and much of the practice also, and a great number of mechanical terms have acquired an universal and exact signification, many of them being derived from the exact sciences. All learners should strive to learn the exact signification of mechanical terms, and then use them properly. The old joke on the new apprentice boy, of sending him around the shop to the journeymen to borrow a "round square," was not a bit more ludicrous than for the foreman to send the same boy to the drawer to get a "three square" file. They should remember that anything "straight" cannot be straightened, that a circle cannot be made more circular, that anything perfect cannot be made more perfect. They should not talk of a three-square file, or a six-square nut or an "eight-square" bar of steel, when they mean a taper file, a hexagon nut and an octagon bar of steel.

Many of these provincialisms have come to us from the old country, and some of them have been adhered to with such pertinacity as to have secured a somewhat doubtful recognition among mechanical writers. For instance, calling a gang of pulleys (a series of pulleys of regular varying diameters, arranged to revolve together, in conjunction with another similar series, for the purpose of changing speed, by shifting a belt, as is done on lathes and other ma-

chines) a "cone pulley;" whereas a "cone" pulley is a well-known but quite different device, which has no other name that I am aware of.

If young men, learning trades, who have not had a mathematical training, would become familiar with a few terms having a general application, it would save much ambiguity and time in giving instructions and explanations by engineers, draughtsmen and foremen. For example, the terms perpendicular, horizontal, vertical, plumb, level (the two latter are the names of tools), angle, acute angle, right angle, obtuse angle, and how to read angles by degrees, spherical, circular, cylindrical, round, square, triangular, conical, pyramidal, prismoidal, axial, central, circumferential, radial, longitudinal, transverse, diametral, a plane surface, rotary, reciprocating, oscillating, intermittent, continuous, front, rear, before, after and many others, some of which are misused, and many others not used at all.

I may, perhaps, call more general attention to this subject, by a single illustration, to show how imperfectly some words in general use are defined or understood, by asking some of your readers to give in your columns a general definition of the term "wheel," which shall include every known species. Olin Scott.

Bennington, Vt., Feb. 26, 1881.

Shapes of Planer Tools.

Editor American Machinist:

The planer tool represented in my communication of last week, I see fully illustrated by Mr. Joshua Rose in this week's issue of the Machinist, and covers the ground more fully than I had done.

I, however, beg to differ with Mr. Rose in its application to a slide lathe, unless it be in the case of very heavy work, and then only as a finishing tool. I find that, in turning shafting and similar work, it is the work that springs more than the tool, and, consequently, the position in which the tool is set has more to do with its action than has the shape of the tool.

The cuts Nos. 1 and 2, given by Mr. Rose, exactly accord with my views, but Nos. 3 and 4 do not.

The cutting edges of these tools are represented at a horizontal line with the center of the lathe. If this is not a mistake of the engraver, I must beg to differ with him here; not so much as to the shape of the tools, as to their positions relative to the lathe center. I have found that the success of a lathe hand depends much on his good judgment in setting a tool at the proper height, and especially is this true with springy work.

As to turning perfectly true cylindrical forms, a good lathe is of first importance, but much depends on having sharp tools.

No tool should be used without first whetting off the grindstone marks, and hence every lathe and planer should have an oil stone. The usual length broken in two makes a size convenient to hold in the hand.

I know many shops where such a thing is not known, and these manufacturers wonder why their products do not sell as well as others.

To return to the original subject, "the springing-away" theory I believe to be right, and the goose-neck tool the proper one for a planer, but I don't think it applies to a lathe, unless it be in taking a finishing cut from a heavy roll or pulley, and where the piece being turned has but little spring, if any.

There is something about the action of a boring tool that I would be glad to have some of your many readers explain.

Why is it that such a tool always cuts more smoothly when feeding out of, than into the hole being bored? I believe all will agree with me that it does so.

The accompanying sketch will show that with some lathes the tool will spring away from its cut, and on others in the direction of the cut. If the rest be very strong and well fitted, then the center of deflection will be at *A*, and the point of tool will spring toward the cut, as shown. But if the tool be a strong one, and the rest to which it is attached imperfectly fitted, then the center of vibration will be somewhere near *B*, and the point of the tool be thrown away from its cut by any tendency of the rest to yield.

Why is it, then, that such a tool invariably cuts smoothly while feeding in an outward direction, and generally chatters while feeding in the opposite direction? Quirk.

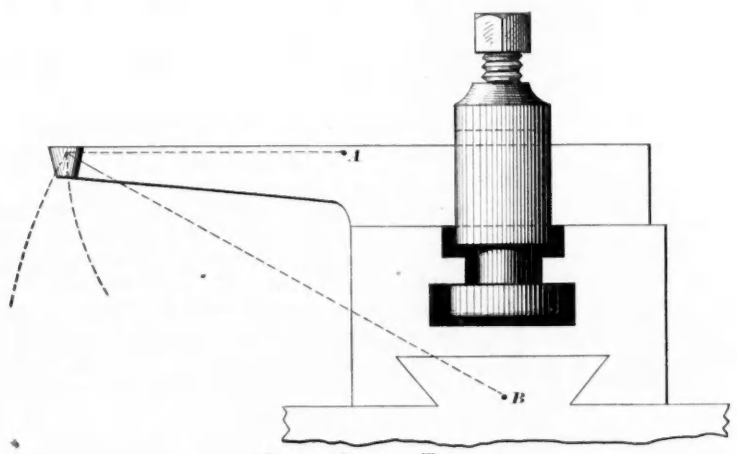
Tight and Loose Pulleys.

Editor American Machinist:

I will venture to make a suggestion upon the above subject, as it is worthy of adoption. How often we find in the workshop, especially where a long line transmits power to a large number of tools, that some of the belts happen to run off and get wound up or a counter shaft pulled down. Let it be that the engines supply power to a large number of tenants who do not care to be annoyed by frequent stops simply because a belt is to be laced, or a belt is caught. Now and then an accident occurs; some one is caught by a set-screw, perhaps causing death before the engines can be stopped, when, if every owner of steam power would positively require that each and every one of his tenants should place on his main line a tight and loose pulley arranged to stop in an instant, it would be of great benefit, not only to the tenant hiring power, but to all parties. In a short time it would more than pay for the extra width of pulley. Let some one try it and see how it is for himself, and if it does not prove, in a short time to be just what is wanted, just drop me a line.

C. E. Simonds.

London St., East Boston, Mass.



Lathe Boring Tool.

Improvement in Metal-Working Presses.

A late improvement in sheet-metal working presses made by E. W. Bliss, of Brooklyn, N.Y., is to dispense with the metal coil springs heretofore used inside the combination dies, used with certain forms of these presses in the manufacture of can-tops and bottoms, for throwing out the work. A heavy cylindrical rubber spring is placed in the mandrel above the upper die, while another in the form of a tube is placed in the bed-plate or bolster below the lower die, accomplishing the same result, without danger of weakening or getting out of order.

Newly Incorporated Companies.

PENNSYLVANIA.

The Stubbeline Patent Company, Philadelphia; James P. Scott, R. D. Barclay, and others, incorporators; Capital, $100,000, in shares of $50 each. For purchasing, holding, working, selling and dealing in patent rights and inventions, particularly improvements in puddling and heating furnaces. March 10.

The Moorehall Foundry and Machine Company, Schuylkill, Chester County; Zachariah Acker, Charles F. Batt, and others, incorporators; Capital, $25,000, in shares of $50 each. For the manufacture of iron, steel, copper, tin and other metals. March 17.

MASSACHUSETTS.

Springfield Shuttle Company, Springfield; E. Morgan, President, R. F. Haskins, Treasurer; Capital, $100,000. For the manufacture and sale of sewing machines and sewing machine supplies.

The Boston Elevator Safety Company, Boston; Oliver Warren, President, Nathan Warren, Treasurer; Capital, $200,000. To purchase, use, and sell to others to be used throughout the United States, the invention of John H. Kazar, as secured by patent.

Shaw Locomotive Company, Boston; Frederick W. Nickerson, President, Thos. E. Moseley, Treasurer; Capital, $1,000,000. For making, selling and licensing others to make, use and sell locomotives under any and all patents owned by said company.

The Northern Railroad Company of Long Island; Joseph L. Lewis, A. H. Baldwin, and others, incorporators; Capital, $1,000,000. To construct, maintain and operate a railroad, commencing at foot of Fulton avenue in Astoria, Long Island City, running thence by most direct route to village of Flushing, thence to Great Neck, Hempstead Harbor, Glen Cove, Oyster Bay, Huntingdon, and terminating at Northport. Length of road, about 40 miles.

Lawrence Line Company, Lawrence; Hiram F. Mills, President; Luke S. Mills, Treasurer; Capital, $15,000. For the manufacture of lines, cords, braids and insulated wire, and machinery for the manufacture of the same.

NEW YORK.

The E. M. Birdsall Company, Auburn; Edgar M. Birdsall, Henry C. Mosher, and others, incorporators; Capital, $125,000. To manufacture and sell portable engines, grain threshing, agricultural machines and other machinery.

United States Tube Rolling Stock Company, New York; Geo. H. Raynolds, Wm. R. Bergholz, and others, incorporators; Capital, $500,000. To manufacture, let and sell locomotive engines, cars, rolling stock and machinery. To acquire patents and interests in patents, and to grant licenses to others to manufacture.

Iron and Bullion Furnace Company, New York; Henry A. Spears, Ira Hersey, and others, incorporators; Capital, $2,500,000. To mine and smelt iron gold, silver or other ores. To purchase and erect furnaces, and such manner of things as may be incident to the business of said company.

The New York, Pennsylvania and Western Railroad Company; Geo. D. Chapman, Charles E. Kimball, and others, incorporators; Capital, $2,000,000. To construct, maintain and operate a railroad commencing in the town of Willing, Allegany County, N.Y., near State line between New York and Pennsylvania, and running by most direct route via the towns of Willing, Wellsville, Scio, Amity, Angelica, Belfast, Cunadea, Rushford and Centreville, Allegany County, and sundry towns in the counties of Cattaraugus, Wyoming and Erie, and terminating at or near the City of Buffalo. Length of road about 95 miles.

The Prall Superheated Water Company, Brooklyn; Wm. E. Prall, F. B. Wheeler and others, incorporators; Capital $2,000,000, shares $100 each. To manufacture and sell machinery adapted to heating, cooking and motive purposes, under patents granted to Wm. E. Prall, and to supply buildings with superheated water, for heating, cooking and motive purposes.

Kansas Sugar Manufacturing Company, New York; Wm. L. Barker, Francis H. Holton and others, incorporators; Capital $500,000. To manufacture sugar and molasses and their adjuncts in the State of Kansas, under patents owned by "Morrell Sugar Evaporator Company" of New York City.

The Boynton Saw and File Company, New York; E. Moody Boynton, Thos. P. Cummings and others, incorporators; Capital $30,000. To manufacture and sell saws, files, ice chisels, and hardware of similar character.

Solenoid Telephone Company, New York; Samuel L. M. Barlow, Geo. B. Post and others, incorporators; Capital $200,000. To manufacture, operate and license to manufacture and use, various apparatus used in the transmission of signals and communications, and to purchase, license and sell patents relating to the same.

The Long Island City and Flushing Railroad Company; Egisto P. Fabbri, Charles Knoblauch and others, incorporators; Capital $500,000. For the purpose of purchasing and reorganizing "The Flushing and North Side" Railroad Company.

The Citizens Petroleum Gas Light Company, of Ithaca; Wm. Smith, O. D. Nelson and others, incorporators; Capital $50,000, shares $50 each. To manufacture and sell illuminating gas in the town of Ithaca, under patents granted to Wm. Smith.

The Standard Petroleum Fuel Company, New York; B. F. Sherman, Chas. W. Copeland and others, incorporators; Capital, $250,000. To manufacture, use and sell all kinds of furnaces, engines, boilers and machinery, adapted to the use of petroleum as fuel.

Adirondack Pulp Mills, New York, and Edwards, St. Lawrence county; H. M. Munsell, A. Corbin, Jr. and others, incorporators; Capital, $500,000. To mine, dig, manufacture and sell tale, asbestos, soapstone, pulp, or other fibrous material or substances.

The Mechanical Company, New York; Chas. B. Waite, William A. Stephens and others, incorporators; Capital, $200,000. To manufacture, purchase and sell plates of metal or other substances, from which may be taken by engraving, printing, etching, photographing, electrotyping and other processes, letters, characters, designs, etc., and to manufacture and deal in all materials used in said business.

United States Concave Spring Company, New York; J. W. Krepps, William Davison and others, incorporators; Capital, $200,000. To manufacture and sell steel springs under Edward Spaulding's patents, and to license others to manufacture and use such springs.

The Rankin Ice Manufacturing Company, New York, Thomas L. Rankin, James B. Brown, and others, incorporators; Capital, $3,500,000. For the manufacture and production of ice by artificial means, and the manufacture of machines for the production of Ice and refrigerating purposes.

The New York Color-Printing Attachment Company, New York, E. L. Snow, Eli S. Hoadley and others, incorporators; Capital, $250,000. To manufacture, sell, lease, or use Bacon's patent color-printing attachment for printing presses, and to license others to manufacture the same in States of New York, New Jersey, Pennsylvania, and Delaware.

Mohawk Valley Beet Sugar Company, Schenectady; Jno. D. Campbell, Henry S. De Forest, and others, incorporators; Capital, $150,000. To manufacture, refine and sell sugar from beets or other materials.

Polar Oil Company, New York; John H. Hebert, A. F. Comer and others, incorporators; Capital, $200,000. For the purpose of gathering crude oil or petroleum, and refining and manufacturing the same for sale.

The Horton Manufacturing Company, Jamestown; Wm. K. Vandergift, Wm. H. Blackstone, and others, incorporators; Capital, $18,000. To manufacture and sell corn planters, washing machines, furniture, patent specialties, agricultural implements and general wooden work.

The Kendall Bank Note Company, New York; George H. Kendall, L. H. Starkey, and others, incorporators; Capital, $10,000. For the purpose of engraving steel plates and printing therefrom, manufacture of lithographs, and the production and sale of art subjects.

The Easy Starting Whiffletree Company (limited) New York; Adam E. Schatz, Chas. F. Koehler and others, incorporators; Capital $30,000. To manufacture and sell and license others to manufacture and sell whiffletrees, constructed under patents granted to Adam F. Schatz.

The Johnson Manufacturing Company, Brooklyn; Albert F. Johnson, Horatio S. Stewart and others, incorporators; Capital $25,000. To patent and manufacture telegraph devices and machines.

Continued from page 3.

The table is adjustable vertically by means of a powerful screw and double-ratchet lever. A rack and pinion feed is provided for moving the lumber horizontally under the chisel, an adjustable clamp holding it securely to the table. The table also adjusts to and from the machine and tilts for bevel work.

The chisel is reversed by Smith's friction belt. The chisel progresses into the work gradually, the whole head stock with chisel bar and crank shaft being propelled downward by a large screw controlled by a foot lever. The shock of the chisel stroke is nearly all absorbed in the weight of these moving parts, and very little of it is communicated to the screw; no more than is communicated to the screw under the table. The bearing in the reversing cylinder is made of bell metal, split and adjustable to keep the chisel bar true.

For car and agricultural shops the machine is usually supplied with two boring spindles, one in line with the chisel for boring hard wood previous to mortising, the other having an adjustment across the table for boring bolt holes, &c. Both of the boring attachments are driven by a single belt direct from the crank shaft, and can be started or stopped in a moment with shifting clutch levers.

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NEW YORK, APRIL 9, 1881.

CONTENTS.

PAGE.

A New Type of Compound Pumping Engine..... 1
Extracts from Chordal's Letters..... 1
Shop Kinks. By L. F. Lyne..... 2
Pumping Machinery. By Chas. A. Hague..... 2
New Car Mortising and Boring Machine..... 3
Combined Lathe and Drill Chuck..... 3
A Compression Shaft Coupling..... 4
A New Emery Grinder..... 4
Explainable and Unexplainable. By F. F. Hemenway..... 4
Letters from Practical Men—Dry Horse-Hide Belt Lacing—An "Arkansaw" Engine Test—A Pair of Queer Indicator Cards—Some Reasons for Crooked Threads on Pipes—Do Stays Stay?—Mechanical Provincialisms—Shapes of Planer Tools—Tight and Loose Pulleys..... 5, 6, 7
Newly Incorporated Companies..... 7
Improvement in Metal Working Presses..... 7
Machine-Shop Productions..... 8
A Competitive Governor Test Wanted..... 8
The Universal Critic..... 8
Literary Notes..... 8
Questions and Answers..... 9
Manufactures..... 9
Machinists' and Engineers' Supplies..... 10
Iron and Metal Review..... 10

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Machine-Shop Productions.

Since the mechanical part of the business boom has filled our machine shops with work, and created a demand for more shops, the prevailing problem in many minds of practical men is the proper selection of something most desirable to manufacture in a new shop by a new business concern. Those who are about to start out for themselves, whether they have been employed by others, or have been associated with others as joint proprietors of a shop business, are presumed to be well informed of the condition of production and distributive demand in the particular line in which they have been engaged; but whether some other line of production would not be more remunerative in the long run, or more suited to their tastes, is a matter for profound deliberation. The amount of capital at command, will, of course, in a large measure, influence the choice. In many branches of the machinery business it would be exceedingly difficult to organize and successfully conduct a new manufactory without considerable capital to start with, such has been the perfection to which shop processes and inventive skill, coupled with large resources, have brought the low cost and excellent character of the articles manufactured. The building of steam pumps, for instance, is an industry employing some thousands of men in this country, and is supported by a demand as widespread as are our mechanical establishments; yet it offers less brilliant inducements to a shop just starting than some other specialty, for the general reasons just mentioned. Some may urge that an experienced mechanical engineer should be over-cautious about risking his accumulations of years of labor and enterprise in a business of which he knows very little practically, and in which he is to assume the chief responsibility of a new establishment. Even if this is admitted, it would seem that a skillful builder of steam pumps ought to prove skillful in either of a hundred-and-one other mechanical branches, after a short period of special study, to familiarize himself with the salient points of the business. As to selling the goods but few fears need be entertained, if the articles are correctly designed, well made, and last, though not least, are of a class for which a good demand already exists. There is too little elasticity in some of our best mechanical engineers.

It is not a wise policy to adhere doggedly to some specialty where the chances for profitable returns are very remote and obscure.

In selecting an article for manufacture it is best to allow a liberal margin for shrinkage in the anticipated number and value of customers. Where the object is a machine that at most will be required by a very limited number of concerns, and it is necessary to secure orders from two-thirds or even one-third of them to make the business a success, the projector of the enterprise needs to have a super-heated confidence in his ability to bring those concerns to the buying point, as well as an unlimited faith in the machine itself. Either want of conservatism in some ardent missionaries of mechanical progress, or an excess of it in hoped-for customers has, time and again, caused the failure of a shining enterprise, based upon the ability of some of the former class to induce the mechanical public to discard long-used contrivances, for what promised to be a hundred per cent. better.

In looking over the various lines of mechanical productions, there are occasional promising ventures for business in new shops. The growing importance of our mining industries will necessitate an increasing production of mining machinery. Comparatively few shops are now making this kind of machinery an exclusive specialty. The demand for agricultural machinery and tools is now met by a number of very large shops, that find their capacity, great as it is, scarcely sufficient to keep abreast of their orders. Even when the unusual activity in manufactures shall have been passed, our agricultural industries are not likely to shrink in the same proportion. The foreign demand for both mining and agricultural machinery is one that can safely be counted upon to develop itself largely. The supply of all kinds of steam machinery would seem to be ample, both in quantity and variety, but indications point to a demand greater than has yet existed for coil boilers of approved construction, especially for marine purposes. This leads us to the suggestion that the building of steam launches is a specialty of rapid growth, depending, however, to a great extent, upon the stability of popular tastes and fashions. When beet sugar factories are sending abroad for their machinery an extension of this mechanical industry in our own country might prove profitable. Considerable cane sugar machinery is made for foreign countries, but the growth of beet, glucose and sorghum sugar making in this country gives rise to a demand for special machinery for these factories. For those who possess both inventive and constructive skill, the origination of special machinery for various purposes offers an almost unrestricted field for mechanical enterprise. Mechanical engineers who have small capital and large ability, will often find a more inviting prospect for successful business in *building* machinery than in *manufacturing* it. Designing and building special machinery would, in such cases, be the right selection.

The manufacture of small shop tools is an industry that produces very good returns to many establishments, and is far from being overdone.

Altogether, the selection of lines of productions for new machine shops is not exceedingly difficult.

A Competitive Governor Test Wanted.

Steam engine "tests" we have in plenty, but why is it we cannot have competitive governor tests? Certainly it cannot be because of any deep-seated conviction that the governor relates to an unimportant feature of steam engine economy, because everybody knows that each of the governors made in this country, is, in the opinion of its manufacturers, the best governor extant.

Now, with numerous governors in the market, each claiming to control the revolutions of the engine thirty to forty per cent. better than any other, obviously such a test to be satisfactory should include tests of several governors applied under precisely the same conditions. This would imply that all should be applied alike to the same make of engine, and to several sizes of engines, if the tests were designed to be complete. But in view of the probability that a governor may behave well with one kind of engine, and badly with another, several different engines should be in position, and each variety of governors should make the rounds and be tested upon all. This would give the steam-using public data of material value. By all means, let the next great steam engine test be a grand combination show, with its results seen and read of all men.

The Universal Critic.

One of the familiar figures of the day is the universal critic. Every branch of business has him. For the matter of that, every branch of business needs him—not that he ever does much himself, but because his relation to achievement is like that of Falstaff to Wit, in that he is the cause of it in others. Looking down from the lofty heights of prescience, he discovers, usually, not so much that a specific thing is wrong, as that everything is wrong. To his mind a fault is mainly noteworthy for what it represents. He is like the doctors who cure the disease by attacking the symptoms. With him in such cases one swallow always makes a summer.

The real universal critic seldom pays much regard to consistency. Is an enterprise talked of? He will demonstrate to a nicety that it is preposterous, unless done so and so. When the enterprise shows signs of being carried to a substantial issue, the critic of yesterday changes sides, and sees much in its favor under certain circumstances. If the enterprise is public in its nature, a place on the principal committee is given him, not usually from regard to fitness, so much, as the desire to satisfy him. Afterwards he will not feel in the least bound to abide by the results of compromise between his own crudities and the combined wisdom of the mass, but fiercely attacks, or ostentatiously withdraws from the movement, upon grounds often wholly illogical. Small flings at the capacity or conduct of his late associates are thereafter always to be expected from him, as a matter of course.

The universal critic judges everything according to preconceived standards.

It often follows that his judgment is wrong, as the situation may perversely refuse to be judged in this way. In such cases the observer is treated to the spectacle of quiet composure on the part of the situation, and utter helplessness on the part of the critic. Yet as the tendency is innate, after the first flurry these cases are regarded by him as the exceptions which prove the rule. The necessity of proving them to be the rule, and not the exception, is therefore laid upon all others interested, and hence comes progress.

In the shop, the universal critic is sometimes eminently useful. Not only when he is wrong, but when he is right, does he often exert a wholesome influence, though in an unwholesome way. He conserves progress, and stimulates conservatism. He cries out against invention, and derides the mass who never invented anything. He seldom shows in advance how a thing should be done, but is prolific in amendments after it is done. Yet, this often gives others the cue to newer and better ways, and is, therefore, desirable.

Being judicially minded, the universal critic is usually too intent upon seeing all sides to grasp any. His thought is merely the grouping of ideas. He is like the schoolmaster who grades his pupils in their classes according to their height. Yet none can deny that an unjust gradation may stimulate effort in many instances. The pupils who are graded too high are forced to mental effort in order to qualify themselves for their position, while those who are graded too low, smart from a sense of injustice, and work from pique.

If the universal critic is a shop owner, he divides his days between the belief that there is only one perfect manufacturing establishment in the world—his own—and his native propensity to discern and magnify evils. On his good days he is only moved by wheedling. On his bad days, he unconsciously incites to mutiny. The more his good or great qualities are appreciated, the more he is pitied by his apprentices.

If the universal critic is a foreman, he believes there is only one way in which to do work, and this way varies uncertainly with the work to be done. As the true universal critic works according to a hidden law, the average workman cannot hope to anticipate its action. Hence, dependence and often duplicity are the natural results. Men who expect to be judged by erratic standards soon regard themselves as judged less by thought than by freak. Crookedness governs itself accordingly, while honest virtue is forced to be its own reward. Still, all things considered, there are many good points to be found in the nature and work of the universal critic, and it is by no means clear that even the best regulated shop can afford to be without him.

Literary Notes.

After a long delay, a number of the papers have been officially issued relating to the first annual meeting of the American Society of Mechanical Engineers, held at the Union League Theatre, New York, November 4th and 5th last. The papers so far issued comprise a general report of transactions, and the inaugural address of President Thurston; and the papers read by Prof.

John E. Sweet, and Messrs. Coleman Sellers, A. L. Holley, and J. C. Hoadley. Very properly, the admirable opening address of Mr. A. L. Holley, chairman of the preliminary meeting for the organization of the society, held at the office of the AMERICAN MACHINIST, February 16th last, is appended, under the well-chosen title, "The Field of Mechanical Engineering." We presume the remaining papers will soon be issued.

Our new book, "Extracts from Chordal's Letters," has received a large number of very warm commendations from both the daily and technical press. We give a few extracts from the latter herewith:

Not only interesting to machinists, but to people who are not machinists—they are so full of sharp hits at so many human failings, and often humorously depict the short-comings of mankind in general, besides abounding in strong common sense. Every skilled mechanic connected with the blast furnaces, rolling mills, and steel works in this country, will find within the covers of this book, matter that will please, entertain and instruct him.—*Bulletin of the American Iron and Steel Association.*

They are not only full of sound, practical common sense, but they are bristling all over with quiet fun, and present the good advice they contain in such palatable shape, that no man who begins to read is likely to lay the book down until he has read it through, or determined to do so as soon as opportunity offers. They are familiar talks with machinists, intended to educate them in many things, concerning which they have strong prejudices not easily reached by serious argument.—*The Iron Age.*

These selections from the contributions of "Chordal" to the AMERICAN MACHINIST make an interesting, entertaining and usefully suggestive addition to the literature of the machine shop. The author discusses shop work and shop management with much practical shrewdness, and in a manner that mechanics, artisans, and wide-awake working men generally cannot help but enjoy.—*Scientific American.*

We know of no work on mechanical subjects which we can commend with such heartiness. Books on such topics are usually dull reading even to mechanics, and just here is where the "Extracts" differ from all other practical works we know of. It is *readable;* not only to those who are engaged in mechanical pursuits, but to all who have the slightest interest in such things. "Chordal" (and, by the way, an excellent portrait of him prefaces the book) has a most felicitous style, and a taking way of telling things that makes one warm to him at once.—*American Miller.*

The admirers of his letters, on practical mechanical subjects, will hail with pleasure their appearance in this neat little volume. It is one of the most practical works for practical mechanics that has been published for many a day, and should be put into the hands of every wide-awake, intelligent workman in the land.—*Boston Commercial Bulletin.*

The writer has a remarkable faculty for writing upon the dry subjects of machine shops and their working appliances in a highly interesting manner, combining practical information evidently drawn from long experience, with machinery with no little entertainment. A vein of real humor running through the discourses in no way detracts from their value, as practical instruction to those engaged in handling machinery.—*The Railway Age.*

For pithy wisdom and keen wit applied to mechanical and technical topics, but couched in terms intelligible to all readers, it would be hard to find the equal of these sprightly practical, discursive letters.—*Engineering and Mining Journal.*

Chordal is a thoroughly practical man, an acute observer, and a ready and original writer. Its keen and accurate observations on human nature make it interesting to the general reader, who has no particular interest in shop matters.—*Northwestern Miller.*

We have read it from beginning to end with so much interest that when the end was reached, we wished there was more of it. Though evidently written for the mechanic, it maps out so correctly the ways of human nature, and its teachings are so broad that any employer or employe, no matter in what business engaged, would find it a mine of healthy suggestion and instruction. At times, the blunt and epigrammatic style is charming and is made so to a greater degree by the humor that bubbles to the surface when one is least expecting it.—*Northwestern Lumberman.*

It touches upon almost everything pertaining to shop economy and management. It will be read with instruction and profit by the apprentice and experienced mechanic, because it is free from technicality and abounds in valuable practical suggestions and illustrations of every-day shop life, methods and incidents.—*National Car Builder.*

It requires genius to rob mechanical subjects of the dryness with which they are invested to the ordinary reader. The readers of the AMERICAN MACHINIST will not need to have these spicy, amusing and instructive letters commended to them. To others we may say that the author ranges over a wide field in his treatment of the science of mechanics, and the artisans themselves who are known as mechanics and machinists. He is intensely practical, and abounds with useful hints and excellent suggestions. He is conversational in his style, uses no big words because they are big, but adapts himself to all classes of readers. His book is eminently *readable*, and there are not many books by mechanical engineers of which this can be said.—*Chicago Railway Review.*

For two years past, an unknown but skilled hand, writing under the *nom de plume* "Chordal," has been delighting the readers of the AMERICAN MACHINIST with simple, every-day illustrations of shop-life and incidents, shopmen and masters, shopways and methods, shop success and failure. Many are the men, who, after having groped through an apprenticeship unaided by the printed experience of others, simply because that experience was not such as they could grasp, have by these letters gotten a new light on many points in their professions, even at the meridian of their journeymanship.—*The Age of Steel.*

The object of these letters has been to adapt them to persons who rarely read any technical literature. Written in a desultory, unconnected and broken paragraphic form, "Chordal's Letters" is just the book to take up for snatch-time reading at noon-day lunch or at evening. It contains numerous forceful illustrations and amusing conceits in the way of sketchy tail-pieces, none of which appeared in the letters when published serially.—*Leffel's Mechanical News.*

We have never known a regular contributor to a technical journal, whose writings made such fast friends of his readers in so short a time as "Chordal." He is the Bob Burdette of technical journalism, always witty and never vulgar; full of sense and ripe experience, which make his articles worth the reading many times over.—*The Millstone.*

This is a highly interesting book, and its first chapter opens in a wholesome and manly way that will win the good will of sensible readers from the start. The book is full of workshop experiences. It is written in a lively style; is full of anecdote, and is moreover enriched with a number of exceedingly apt engravings.—*American Grocer.*

The book is one that cannot fail to interest practical machinists and mechanics, as well as proprietors of machine shops. The author is evidently posted upon shop practice as it is, as well as upon what it should be.—*Western Manufacturer.*

The letters are eminently practical, and evince a knowledge of matters relating to machinery and shop work, such as can only be acquired by the closest observation and long experience. Withal there is a spice of ready humor, appetizing to a high degree.—*American Ship.*

The author of this work has succeeded in producing a very interesting and amusing volume. Interspersed with some excellent ideas of shop management and good advice to workmen, are discussions of practical mechanics, and some ludicrous examples of bungling and crude workshop practice.—*Blacksmith and Wheelwright.*

They are in a familiar style, clear cut as a crystal, and full of sound, practical information for mechanics.—*Sewing Machine News.*

This is one of the few books, which, while treating on a dry subject, is entertaining, amusing and instructive. The author clearly shows that he is both theoretically and practically up with the times, and his suggestions display a keen insight into "men and things."—*Chicago Industrial World.*

Having been editor of the carriage-builders' trade journal for twelve years, I have had opportunity to learn what appeals to the mechanic and what can do him good; and the beneficial influence of such plain, practical, intelligent, unconventional, honest, manly letters as these, void of all cant and humbug, and evidently written by one of them is undoubted. The book cannot fail to attract, interest and instruct mechanics—a class hard to reach, but thoroughly appreciative when reached.—*Editor of the Hub.*

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1.) H. E. K., Toronto, asks: Which is the better set of back-gears for a lathe swinging 8½", geared 3 to 1,—the set bearing, respectively, 5-16" pitch and 1" face, and ¼" pitch and 1¼" face—which is the most suitable as regards power and smoothness of motion? *A.*—The set with ¼" pitch and 1¼" length of teeth, is the best, for the reasons that the greater closeness together of the teeth give steadier motion, and the teeth being as strong as the other set combine power as well.

(2.) W. J. B., New York City, asks: Which of the Elevated Railways is the strongest, that on Third Avenue or Sixth Avenue, in this city." *A.*—The Sixth Avenue road is most heavily trussed and designed for the most substantial structure. The Third Avenue line is the lightest and of most symmetrical design, and shows in use equal strength. Both are designed for ample support of the trains, from well-established rules and practice in iron-trussing. It would be difficult to show where one greatly differs in strength from the other, without a very carefully-made series of diagrams and calculations, with tests of the material used in their construction.

(3) A. S. & Co., Sharpsburg, Pa., asks Will you please give us some advice in regard to setting the furnace of our "Planing-mill boiler." The boiler is 42" diameter, 26 ft. long, with two 16" flues; stack 30" diameter, and 35 ft. high; grate-bars 42" wide, set 16" from center of boiler; sides of furnace flared up to above water-line of boiler. Bridge-wall built up to within 8" of boiler; rear of bridge-wall about 12" space below boiler along to rear. It consumes, we think, entirely too much fuel, and we would be obliged to you if you can suggest the way to remedy it. *A.* We think, with the fuel you use, the draft is too strong over the bridge-wall into the stack, and would advise more clearance of the furnace over the bridge. You do not state whether you have a damper in the chimney or not, but there should be one used in all cases.

(4) J. W. W., Beverly, N. Y., asks: Please name the kind of metal to use and the manner of using it for brazing steel. *A.*—Sheet steel or thin pieces such as band saws are generally brazed with silver solder which is sold in strips. For brazing a band saw, the ends are to be tapered off so as to form a common scarfed joint. The ends are to be securely held in position leaving a space all about the joint. A piece of silver solder wet with soldering fluid is to be placed between the joint; then with a pair of blacksmith's tongs, previously heated to a white heat, grasp the joint. Sufficient heat will be transmitted to the steel to melt the solder and firmly unite the saw so that it will frequently break in other places than the joint. The tongs should be held in contact with the saw until the solder has set, otherwise the parts will be imperfectly united.

(5.) A. D., Grand Rapids, Mich., asks: Please inform me of the best method of balancing pulleys to run at a high speed; also, can a pulley be balanced accurately on an arbor that is smaller than the hole in pulley? *A.*—All pulleys for high speeds, where practicable, should be turned inside and out, to insure perfect balancing, otherwise they may be placed upon an arbor, and the arbor placed upon two parallel strips. The arbor should in all cases fit the pulley, the bearings upon the parallel strips should be of an equal diameter and as small as consistent. A pulley cannot be accurately balanced upon a mandrel which does not fill the hole. The best way is to place the pulley upon an arbor and speed it up to the velocity with which it is intended to run, putting in a sufficient counter-balance to make it run steady. For a description of such a device, we refer you to an article upon a "New Device for Pulley Balancing," by A. Forrest, in the AMERICAN MACHINIST for Dec. 13, 1879.

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MANUFACTURES.

The Phœnix Machine Company, the incorporation of which was noticed in our issue of March 5th, are putting up a shop for the building of textile machinery at Lowell, Mass. The building is 120x50 feet, and three stories high.

The Washburn & Moen Manufacturing Company, Worcester, Mass., are just completing an enlargement of their works.

The Chapman Valve Manufacturing Company, Indian Orchard, Mass,, are about to build a new foundry.

George R. Lombard & Co., Augusta, Ga., are to add a new foundry and machine shop to their present business.

The Whiting Bros. Manufacturing Co., Cedar Rapids, Iowa, write us: We are just making preparations to extend our foundry forty feet and build an office and storeroom, also, blacksmith shop. Have just cast the first of a pair of Sweet's patent rotary valves for the B. C. R. & N. R. R.

S. F. Hess & Bro, have leased the Excelsior Works in Massillon, O., and intend to engage largely in the manufacture of air and force pumps.

E. Gould & Eberhardt, Newark, N.J., have just shipped, on order, a large combined drill and slotter to Yokohama, Japan.

The Billings & Spencer Co., Hartford, Conn., write us: Business is still rushing. Have just made another quarterly dividend of two per cent., payable April 1st. Have just ordered two more drop hammers. More orders booked than we can fill for the next six months.

The Innis Manufacturing Company, of Oil City, Pa., have received a cablegram from Russia, ordering twenty new engines, which will be used in putting down oil wells in that country.

The Wason Car Company, Brightwood, (Springfield), Mass., made about a million dollars worth of cars last year. They employ 700 men, and are making on the average six freight cars a day and four passenger cars a week. Their pay roll amounts to between $25,000 and $30,000 a month.

The new shop and warehouse of Whiteley, Fassler & Kelley, Springfield, O., manufacturers of champion reapers and mowers—the latter of which is nearly complete, are among the most important buildings being erected there. The shop is 60 x 450 ft., three stories high. The foundation for the main shop is but just begun. When complete it will present a frontage of about 630 feet, besides four wings running back 400 feet for foundry blacksmith's shop, etc. The entire area of all floors is estimated at 15 acres.—*Quincy, Ill., Manufacturers' Exchange.*

The Mason Machine Works of Taunton, Mass,, are about enlarging their capacity for building locomotives and machinery by the erection of a brick building 130 x 60, two stories; also, by building an addition to their blacksmith department.

The old Excelsior Works, Akron, O., are being fitted up for the manufacture of the Empire Mower and Reaper. Considerable additions are being made, and 300 men will be employed.

Taplin, Rice & Co's foundry and machine shop at Akron, O., is being enlarged and improved, and a 10-ton cupola will be substituted for the present one, which is of only 5-ton capacity.

Machinists' and Engineers' Supplies.

NEW YORK, March 24, 1881.

Trade holds its own and promises well for the future. The opening of navigation and the thawing out of a few Northwestern railroads has a favorable effect upon business generally. The firm of Peter A. Frasse & Co., 95 Fulton St., New York, has been changed, by the withdrawal of Charles F. Frasse and the entrance of John L. Howe, with whom Peter A. Frasse has formed a co-partnership under the same firm name as before. This is one of the oldest establishments in the machinist's supply line in the United States. We have received a neat pamphlet entitled "A Treatise on Feed Water Heaters," by Charles E. Ashcroft of Boston, which contains much that is interesting to engineers. The Springfield (Mass.) Foundry Company desire to correct an impression given by an item in our columns a few weeks ago. They wish it understood that the concern is not a new one, having been established over three years, and is now enjoying a large trade in fine grey iron castings.

Iron and Metal Review.

NEW YORK, March 24th.

Pig iron is very quiet, and steady in tone. Prices for American pig rule firm at $25 to $26 for No. 1, $22 to $23 for No. 2, and $20 to $21 for grey forge. Scotch pig is still listless, and without special interest. Sales are made at $24.50 for Coltness, $22 for Eglinton, $23 to $23.50 for Gartscherrie, and $22.50 to $23 for Carnbrae. The railroads are buying both steel and iron rails, quite actively. Steel rails are quoted $63 to $65, and iron, $48 to $50 at mill. Several sales of old T rails have been made at $27.50 to $28, with an upward tendency. No. 1 wrought scrap is quoted at $30 to $31 at yard. Bar iron from store is steady, on the basis of 2.5c. for refined.

The quotations on boiler plate are as follows:

Tank Iron, 3c; Refined Iron, 3¼c.; Shell Iron, 3½c.; Flange Iron, 4¾c.; Extra Flange Iron, 5½c. Mills are very full of work, and demand large.

Ingot copper is quoted 19⅝c. to 19¾c. Straits. Billiton. Australian and common English tin sells at 20c. to 20¼c., with a firm market. Lead is dull at 4⅝c. to 4¾c. for common, and 4⅞c. to 5c. for refined. Spelter sells at 5c. to 5¼c. for domestic. Silesian spelter is not offered. Sheet zinc, 7c. Antimony, 14¾c. to 15c.

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Wanted—New or second-hand caloric or gas engine about 7 horse power. Address, "Caloric," this office.

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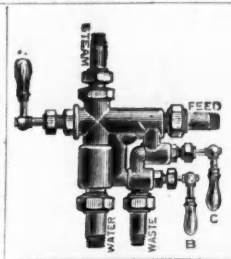

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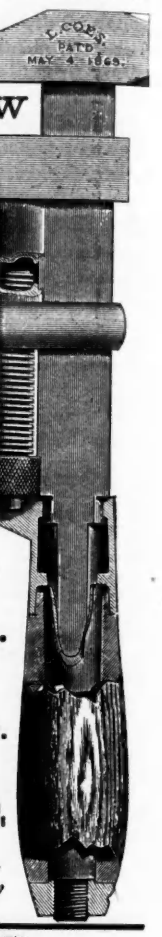

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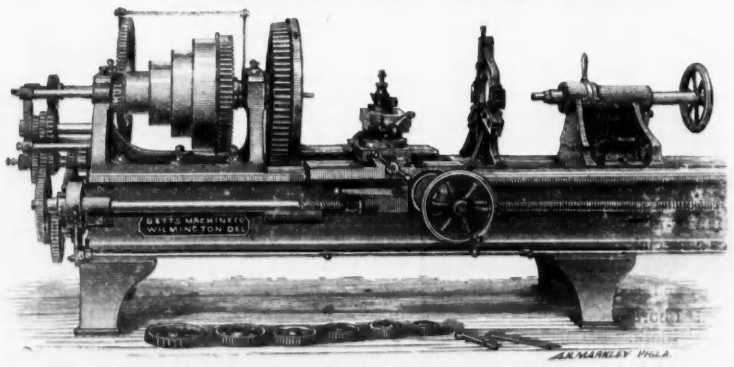

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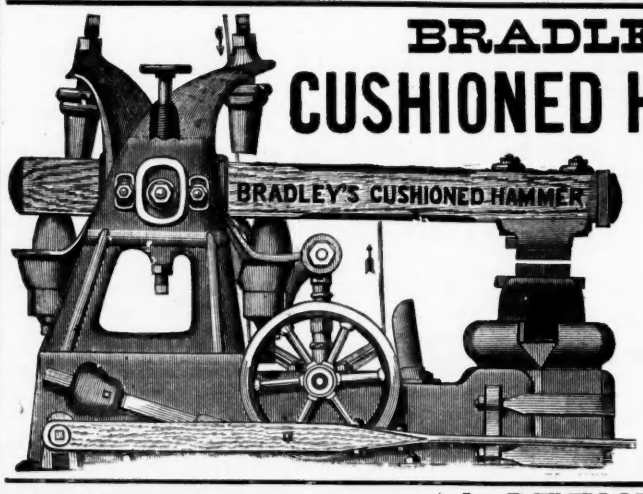

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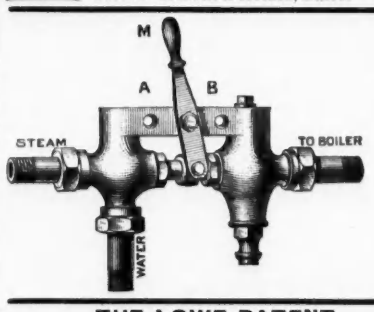

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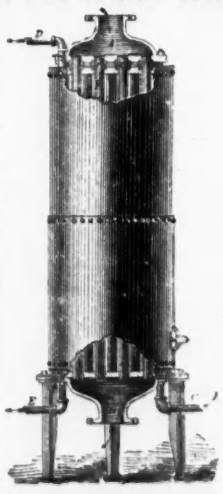

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